

**OPERATIVE  
GYNECOLOGY**

# OPERATIVE GYNECOLOGY

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*488 Figures and 7 Color Plates*



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*This book is dedicated to*

**DR. EDWARD H. RICHARDSON**

*friend and counselor*

*in whom are combined the rare qualities of excellent surgical judgment and an appreciation of fine surgical technic.*

# Preface to the Third Edition

Eight years have passed since the publication of the second edition of *Operative Gynecology*, and sufficient progress has been made in this branch of our specialty to justify an up-to-date edition. Although the author has had a special interest in operative work, he recognizes the importance of the other branches of gynecology. There has been in recent years a tendency on the part of some obstetrician-gynecologists to play down the operative side of the specialty. This is regrettable, for technical excellence at the operating table may occasionally result in saving the woman's life. Therefore, it is the duty of all who practice pelvic surgery to perfect themselves technically to the greatest possible degree.

Nevertheless, this book has never pretended to be simply one of surgical technic. As one becomes older and looks back at his experiences, surgical philosophy becomes increasingly important. What does it profit a woman if the operation is technically perfect and the procedure unnecessary or even harmful? Unnecessary pelvic operations are still done by the thousands, and, therefore, with successive editions of the book a bit more of philosophy has been injected into the text. At least one reason for unnecessary pelvic surgery is a lack of knowledge of gynecologic pathology. This remains the bed rock upon which good surgery is done. Therefore, a considerable amount of pathology is included in this text.

Two new chapters have been added in this third edition. A short chapter has been written on carcinoma of the fallopian tube. This rare and usually fatal disease has been offered a new chance at early detection through cytology and thus becomes of greater importance. A chapter has also been added on cervical incompetence. At the time of writing the second edition the operations for this condition were considered by the author as too experimental to justify their inclusion in a text. However, sufficient data on end-results have now been accumulated to justify the inclusion of the subject in this work.

Extensive revisions have been made in several chapters, and a few have been left unchanged. The chapters on pre- and postoperative care have been thoroughly revised with the assistance of the author's two residents, Dr. Beaury Burns and Dr. Tiffany Williams. In a hospital staffed with competent residents it is they who listen to and alleviate most frequently the patient's postoperative complaints. Their assistance is greatly appreciated.

The chapter on anesthesia has been completely rewritten by Dr. Peter Safar, an expert in this field. In the first two editions the chapter on anesthesia was written purely from the surgeon's point of view by the author, who has had very little practical experience in the actual giving of anesthetics. In recent years anesthesia has made great progress and contributed much to lessening of postoperative discomfort and complications. It has also become more complex and, therefore, it seemed desirable to have the chapter on this subject completely rewritten by an anesthesiologist.

The chapter on surgical conditions of the vulva, the vagina and the urethra has been divided into three separate chapters due to broadening of our knowledge of these subjects and a corresponding increase in the volume of material. Better understanding of the various types of vulval lesions has made it possible to individualize our therapy to a greater degree. The author is indebted to Dr. J. Donald Woodruff from our pathologic laboratory for his help on this chapter.

The author has personally had a greater experience with unusual cases of urinary incontinence, and in the chapter dealing with this subject he has attempted to share some of this experience with the reader.

When the first edition of this book was written our knowledge of carcinoma-in-situ was meager. In the 15 years since then we have had an extensive experience with this important condition, and we hope that our experience is reflected in the chapter on this condition.

Except for a few details in irradiation technic there has been little change in our planned therapy of invasive cervical cancer. We have devoted more space to the radical surgical technic, especially in reference to diversion of the urinary stream. The author still believes that the occasions for ultraradical surgery for cervical cancer are few, but it occasionally may be lifesaving, and the finished pelvic surgeon should be familiar with the technics. The section on cervical cancer therapy has been reviewed by Dr. C. Bernard Brack and Dr. George J. Richards who are in charge of our pelvic malignancy clinic, and the views expressed are in agreement with the practices in our clinic. We have taken a look into possible future changes in therapy based upon radiation therapy sensitivity tests currently being explored by Dr. Howard

Jones and Dr. Hugh Davis of our department.

The chapter on ovarian tumors has been expanded in accordance with a better knowledge of ovarian pathology.

Dr. Georgianna Seegar Jones has reviewed the chapter on functional bleeding and made suggestions on present-day hormonal therapy. Dr. Eleanor Delfs has done the same for the section on habitual abortions.

All of the additions and changes are too numerous to enumerate. Many new illustrations have been added, chiefly drawn by Mr. Leon Schlossberg, and the new photomicrographs are by Mr. Chester Reather. To these artists and to my secretaries who have typed the manuscript the author is very grateful. Finally, the J. B. Lippincott Company has continued to be most co-operative.

# Preface to the First Edition

Gynecology has become a many-sided specialty. No longer is it simply a branch of general surgery. In order to practice this specialty in its broad sense, the gynecologist must be trained in a comprehensive field. He must be a surgeon, expert in his special field; he must be trained in the fundamentals of obstetrics; he must have the technical skill to investigate female urologic conditions; he must have an understanding of endocrinology as it applies to gynecology; he should be well grounded in gynecologic pathology; finally, he must be able to recognize and deal successfully with minor psychiatric problems which arise so commonly among gynecologic patients. With this concept of the specialty in mind this book has been written. It then becomes apparent, when one seeks training in gynecology beyond the simplest fundamentals such as are taught to undergraduates, that special works are necessary for training those who intend to practice it.

More and more this modern conception of gynecology is becoming apparent in the newer works that are appearing in the subject. Within the past decade books on gynecologic endocrinology, medical gynecology, as well as general textbooks on gynecology, have made their appearance. These volumes have been eagerly received, but there seemed to be a void in the books available for training young men in the field of gynecologic surgery. The author has attempted to fill this void with the present volume.

In the early days of the development of gynecology, progress in surgery was rapid and brilliant. Much of this has been recorded in Kelly's "Operative Gynecology." Since these pioneer days, progress has been slow, but there has been advance in surgical technique, in the development of new operations, in the improvement in anesthesia, and in the pre- and the postoperative care of patients. Within the surgical lifetime of the author, which extends for a quarter of a century, operative mortality and morbidity have been greatly reduced as a result of improvements in these fields. Brilliant discoveries have been

few, but the sum total of the minor advances add up to surprising progress.

The present volume attempts to bring the subject of operative gynecology up to date and to make recent information on that subject available in a single volume. The views expressed are those of the author and, in general, those which are put into practice on the gynecologic house service at the Johns Hopkins Hospital. On a service where many attending gynecologists work, differences of opinion are inevitable, and the author's views in this book are not held uniformly by all the attending gynecologists. Indeed, the differences in point of view expressed by the visiting staff are of value to the members of the house staff, causing them to realize early in their careers that all is not forever settled in medicine.

The author is a firm believer in the system of long hospital residencies for training young men in the various surgical specialties when their minds are quick to grasp ideas and their fingers are nimble. This volume has been written particularly for this group of men. Unfortunately, there is a paucity of good gynecologic residencies in the United States in the sense that the author has in mind. Many positions bear the name of residency but fail to give the resident sufficient operative work to justify the name. Another excellent method of development of the young gynecologist is an active assistantship to a well-trained, mature gynecologist. If the assistant is permitted to stand at the operating table opposite his chief, day after day, eventually he will acquire skill and judgment which he himself will be able to utilize as an operator. When such a preceptor system is practiced, it is important that the assistant be given some surgery of his own to do while he is still young. If a man is forced to think of himself only as a perennial assistant, this frame of mind will kill his ability to accept responsibility of his own. However, many must learn their operative gynecology under less favorable circumstances than those of the fortunate resident or assistant. This vol-

ume should be of value to those who, by self-instruction, must acquire a certain degree of operative skill. Finally, it must be admitted that more gynecology is practiced today by general surgeons in this country than by gynecologists. Although this is not ideal, circumstances make it necessary, and much of this gynecologic surgery is well done. It is hoped that many general surgeons will use this volume as a reference book.

In connection with general surgery, it is only fair to say that much has come to gynecology by way of general surgeons of the old school, who practiced general surgery in the broadest sense. Now that gynecology and/or obstetrics has become a specialty unto itself, it is well in our training of men not to swing too far from general abdominal surgery. In spite of the most careful preoperative investigation, mistakes in diagnosis will be made, and at times the gynecologist will be called upon to take care of general surgical conditions in the region of the lower abdomen and the rectum. With this in mind, the author has included in this volume a consideration of a few of the commoner general surgical conditions occasionally encountered incidentally with gynecology or by mistaken diagnosis.

Operative Gynecology is written with the primary purpose of describing the technic of the usual and some of the rarer operative procedures. It also includes indications for and against operations as well as pre- and postoperative care of patients. Although gynecology is divided into several fields, these fields interlock so that it has been found impossible to compose a volume on gynecologic surgery to the exclusion of the other divisions of the specialty. Gynecologic pathology, for instance, is the bedrock upon which good gynecologic surgery is practiced. Without an understanding of it, surgery becomes merely a mechanical job, and errors in surgical judgment are inevitable. Hence, it has become necessary to include in this volume a minimum of gross and microscopic pathology, as it applies directly to the surgical subject under consideration. Also, some consideration is given to psychology and psychiatry in relation to gynecologic surgery. The author believes that getting the young woman on whom a hysterectomy must be done into the proper

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frame of mind to accept it is as important as possessing the technical skill to perform the operation.

The nature of this book has made it essential that it be well illustrated. With few exceptions, the illustrations were sketched at the operating table. The principal illustrator is James Didusch. Without the use of his talents the book could not have been produced. In addition, other excellent medical illustrators have contributed to the volume. These are the late Max Brödel, P. D. Malone, Mrs. Elinor Widmont Bodian, Miss Ranice Birch, William Didusch and Mrs. Grace Elam. The author is grateful to all of them, and the illustrations themselves speak for the quality of their work.

The author is grateful to Dr. Houston S. Everett, who has read the manuscript and made many valuable suggestions. This volume was written during the period of World War II, when the added burden of work caused by a reduced staff would have made the writing of the book impossible except for the co-operation of the resident staff. The resident gynecologists during that period, Dr. Donald Woodruff, Dr. Edward H. Richardson, Jr., Dr. Roger B. Scott, Dr. Gerald A. Galvin, Dr. Constantino Manahan and Dr. David Cheek, have performed several of the operations portrayed and have been helpful in criticizing the sketches. Dr. Charles B. Brack and Dr. George Farber prepared the sections relating to irradiation.

Mrs. Christine Nisbet has read the manuscript and given innumerable valuable suggestions in respect to literary style.

Much of the typing was done by Mrs. Gerald Hopkins, one of the many volunteers during the war period who have made it possible to keep the hospital open. I am grateful to my secretaries, Miss Margaret A. King, Miss Elizabeth Wood, Miss Grace F. Koppelman and Miss Bertha M. Scroggs, for their assistance in typing and looking up references. Dr. Lois Fess has also been helpful in searching the literature.

Finally, E. W. Bacon at the J. B. Lipincott Company has contributed generously from his store of practical knowledge acquired by a lifetime of experience in publishing medical works.

RICHARD W. TE LINDE

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# Preoperative Care and Complications

A surgeon should not be judged solely on his technical skill. His philosophy may be equally and, at times, more important to the patient. It is a *delight to see a technically perfect surgeon*, but if the operation which he performs is not done on good solid indications the patient may suffer a loss rather than gain. Too often a patient is subjected to an unnecessary operation or a major procedure when a minor one would have sufficed. Not infrequently the surgeon operates without knowledge of the basic pathologic lesion and without having given the patient the benefit of a proper diagnostic investigation.

Surgery may be indicated on sound grounds, or it may be done without defensible indications. It may be adequate or inadequate. It may be excessive and only add to the patient's misery. Before performing surgery, the surgeon would do well to consider the three indications for surgery laid down by the late J. M. T. Finney. As a student we frequently heard them and they are, in the mind of the author, worthy of repetition:

1. To save life
2. To relieve suffering
3. To correct deformity

If a surgeon cannot justify his contemplated surgery on the basis of one of these indications, he should take another long look at the problem.

## HISTORY-TAKING

The preoperative care of the patient begins in the office or outpatient department with the careful taking of a complete history. Good history-taking, careful preoperative examination and the preparation of the patient physically and mentally are essential to good surgical results. No matter how busy the gynecologist may be, it is highly desirable

that he personally take the history. Only by this personal contact with the patient can he properly evaluate the symptoms and thus be guided diagnostically as well as at the operating table, where a knowledge of the temperament and the symptoms of the patient is often of great value in making decisions. The importance of psychiatry in gynecology never has been sufficiently stressed, and the personal talk between patient and physician, when she comes to him for advice, may result in great benefit to the patient. Personal contact is also of the greatest value to the physician in permitting him to get an over-all picture of the patient and to be guided in his evaluation of the case by this, rather than simply by his findings on pelvic examination. The maxim that "the patient will tell you what is wrong with her, if you will only give her time" is too often disregarded by the busy surgeon. Good history-taking requires time and patience, and neither of these is found easily in the busy routine of a surgical career. However, the reward for following such a course is the avoidance of unnecessary operations. Such operations, particularly upon neurotic women or those mentally troubled by some difficult problem of life, are not only useless but tend to concentrate the attention of the patient upon the pelvic organs and to aggravate invalidism.

The history should be concise, but accuracy should not be sacrificed for the sake of brevity. For several years it has been our custom to use the form shown above in obtaining the history. There are objections to such a form, for no one ever has devised a perfect form for every case. However, if one uses records for clinical research, important omissions are much rarer when information is compiled on a form. No form is uti-

Name	Age	Date
Address	Reference	Phone
Complaint		
General Health		
Menstrual Age Onset	L.M.P.	P.M.P.
Interval	Duration	Amount
		Pain
Intermenstrual Bleeding		Leukorrhea
Married	yrs. Children	oldest
		youngest
Urinary		Abortions
Rectal		
Operations		
Present Illness		

lized in taking the present illness, and the greatest freedom is permitted the physician in his notes on the present condition. Often there are events in the past history that do not fit into the above form but have an important bearing on the present illness; these also may be recorded properly and completely in connection with the present illness.

A few points which should be stressed in taking a gynecologic history are discussed below:

The menstrual history must be accurate and detailed, since the clue to a correct diagnosis of the lesion for which surgery is considered often appears in the menstrual irregularity. This holds true whether there is an organic lesion or a functional menstrual upset. In fact, a differentiation between functional and early organic disease is one of the most frequent and difficult decisions to make. Of major significance are accurate dates of the latest and the previous menstrual periods. When there is a great discrepancy between the menstrual dates and the pelvic findings in suspected pregnancy, the pregnancy tests are invaluable; but these tests are not infallible, and one may have to overrule the results of the test on the basis of one's pelvic findings and clinical judgment.

The marital history is of great importance in the gynecologic history, with particular reference to pregnancies and their complications such as dystocia, postpartum infections, abortions, urinary-tract infections,

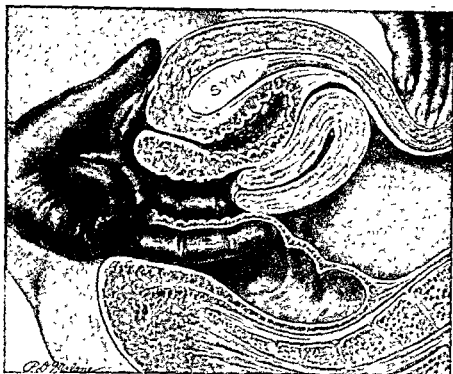
vaginal tears and embolisms. A knowledge of these complications is of value in aiding the surgeon in diagnosis, and also in determining the preoperative studies and the post-operative measures necessary to obviate complications during and after operation. A well-taken marital history may reveal unsatisfactory sexual relations which can prove to be the entire answer to symptoms resembling those due to organic pelvic disease.

The symptomatology of the urinary tract is so closely related to that of the generative tract that in many instances a more or less complete urologic investigation is necessary before making a diagnosis and a decision as to treatment. It is all too common to encounter women who have had vaginal plastic and suspension operations for symptoms of frequency, urgency and dysuria, while the real lesion lay undiagnosed in the urinary tract. It is well to remember that a primary urinary-tract disorder may give rise to symptoms suggestive of generative-tract disease and vice versa. For this reason we have advocated urologic training for every gynecologist. The gynecologist who is adept at using the cystoscope is far better able to evaluate the case than one who must depend on the urologist's report.

## GYNECOLOGIC EXAMINATION

The complete gynecologic examination should include, as a minimum, an examination of the breasts, the abdomen, the pelvis

FIG. 1. Demonstrating recto-vagino-abdominal examination.



and the rectum. Temperature, pulse, respiration, blood pressure, hematocrit and white cell count should be taken in the office or the outpatient department in indicated cases. A catheterized specimen of bladder urine should be examined in all cases in which the symptoms even remotely suggest the possibility of disease of the urinary tract. Recently, work has been published regarding the dangers of catheterization due to introducing infection into the bladder. Having had thousands of catheterizations done in the office over many years, I know of no one who subsequently developed clinical evidence of urinary-tract infection. Hence, we still believe that the procedure should not be shied away from when indicated.

**Breasts** are first inspected as to symmetry, size and the condition of the nipples and the superficial blood vessels. Normal breast tissue, which feels rather shotty with the fingertips, is often erroneously considered to be tumor by patients and even by physicians who are unfamiliar with the proper method of breast palpation. Breasts should be felt with the flat surface of the fingers and the palm; a neoplasm will almost always be palpated in this manner. The breasts are then milked gently, and the presence and the character of secretion are noted. The finding of secretion often gives valuable information when

pregnancy is suspected, but colostrumlike secretion is not uncommon in parous women many years after the last child, and occasionally it is found in women who never have been pregnant.

**Abdomen.** Examination of the abdomen includes inspection and palpation; percussion and auscultation are also useful. Bulging of the flanks suggests free abdominal fluid, but thin-walled ovarian cysts and irregularly shaped fibroids may give a similar picture. Although large ovarian cysts and fibroids more commonly cause protrusion anteriorly, there are many confusing exceptions. Palpation for a fluid wave is a useful procedure. Percussion for areas of flatness and tympany may aid in concluding whether distention is due to fluid or to gas. Areas of localized tympany can be due to intestine between tumor masses. Auscultation is especially useful in differentiating large tumors from advanced pregnancy and in evaluating intestinal activity.

**Pelvis and Rectum.** The routine method of performing a pelvic examination is not considered here, but a few points of major importance are stressed. If the patient is not to be catheterized for the sake of obtaining a specimen, she is asked to void before getting on the examining table. If, after voiding, there is still a suggestion on examina-

tion that the bladder is not completely empty, the patient should be catheterized. To obtain the most satisfactory pelvic examination, it is necessary to place the patient in the most comfortable and relaxed position. These requirements are met most adequately by the dorsal gynecologic position. The bimanual pelvic examination is carried out with two fingers in the vagina on married women, but not infrequently more information can be obtained by vaginal examination with one finger because it is less uncomfortable and the patient is more relaxed. In the virginal woman, a single finger vaginal examination is often possible and should be attempted, but if the patient is too uncomfortable to give satisfactory relaxation the examination had best be done entirely rectally. Rectal examination never should be neglected in the routine pelvic examination for two important reasons: (1) the status of the rectum itself should be learned because of its possible relation to pelvic symptoms; (2) the practice obtained in examining the pelvic organs through the rectum and checking the findings per vaginam is invaluable as a means of educating the rectal finger for use in those cases in which a vaginal examination is impossible. The most valuable gynecologic examination of all is the recto-vagino-abdominal examination. In this procedure the index finger is inserted into the vagina, and the middle finger in the rectum (Fig. 1). This permits an examination of the rectum up to a higher point than when examined with the index finger. It also offers an excellent opportunity for palpation of the pelvic organs by two separated fingers, by means of which more accurate palpation can be done than by the two closely approximated fingers in the vagina. The ability to perform a thorough, accurate pelvic examination and to interpret the findings in the light of the history is perhaps the most important preoperative accomplishment. Finally, when the pelvic findings are doubtful, the examination should be done under anesthesia before making the final decision for or against surgery. As a matter of fact, it is our routine to make a pelvic examination under anesthesia in each case before beginning the operation. Even in those cases in which the pelvic findings seem to be simple and clear, occasionally one

will pick up added useful information when the examination is done under the complete relaxation of the anesthetic. Pentothal Sodium is especially advantageous for this, because relaxation is satisfactory and quick, and the recovery from the anesthetic is pleasant. Relaxation often is improved by the use of curare or other relaxing agents.

A general physical examination is given routinely to all patients admitted for surgery.

### LABORATORY EXAMINATIONS

The hematocrit determination and the white blood count should be part of the preoperative routine work-up of every gynecologic patient. When indicated, complete blood studies are done. A routine urine analysis also should be made prior to even the simplest operative procedure. Fatalities or serious complications occur rarely even after minor operations, and the performing of these routine examinations is a protection to the patient and also, to some degree, to the surgeon. Phenolsulfonphthalein tests and determinations of blood urea or serum urea nitrogen should not be neglected preoperatively, when the urinalysis or the blood-pressure determination indicates the possibility of serious renal disease. X-ray examinations of the chest are done preoperatively when indicated by the history or by suspicious findings at the general physical examinations. When malignancy is present or is suspected, the chest, the pelvis and the long bones should be x-rayed. Blood and urine assays for indicated hormones are done when masculinizing or feminizing ovarian tumors are suspected.

### DISCUSSION OF THE NECESSARY OPERATIVE PROCEDURE

Having concluded that surgery is necessary, the patient and at least one responsible member of the family should be informed. The manner of doing this is extremely important. No matter how busy the surgeon may be, a brief explanation of the situation is greatly appreciated by the patient and her relatives. Apparently, some surgeons proceed on the assumption that their valuable time should not be spent in attempting to give the layman an understanding of the surgical situation. We do not subscribe to

this thought and believe that every patient and her family are entitled to a simple explanation of the problem involved. During this interview, the surgeon may gain or lose the confidence of the patient, and this confidence is an extremely important asset for the surgeon, as well as for the patient, during the convalescent period. One must judge the patient carefully and choose one's words according to her temperament and intelligence. Often it is wise to discuss the situation at first with a relative or a close friend and be guided as to how the patient should be approached by the advice of her friend or relative who knows her much better than the surgeon does. This is particularly true if a question of malignancy is involved. It is our custom always to be perfectly frank with the responsible relative, but only the exceptional patient should be told that cancer is present. Surely, preoperatively, when malignancy is only suspected, it is unwise to terrify the patient by mentioning the possibility of cancer, unless this becomes necessary in order to convince her that she should submit to the necessary diagnostic or operative procedures.

Since curettage for the purpose of ruling out or establishing a diagnosis of malignancy is the commonest of gynecologic operations, it frequently becomes necessary to give the patient an adequate reason for performing an operation for what she often considers to be a minor symptom. It is our custom to tell the patient that the curettage is to be done for the dual purpose of diagnosing the cause of the bleeding and of stopping it, if possible. If malignancy is discovered, and radical surgery and/or irradiation become necessary, the patient is usually told that a condition has been found, which, if neglected and not treated as recommended, might lead to a cancer. In almost every instance, such a statement is strong enough to persuade the patient to consent to any necessary therapeutic measures.

When a pelvic condition is found which requires surgery but is obviously benign, the patient is told the facts frankly, and the reason for surgery is explained to her in layman's terms. The danger involved in the contemplated surgery is faced squarely, and the truth is told to the patient and/or the

family. Fortunately, in most gynecologic operations the mortality rate is not high, and the facts will cheer, rather than discourage, the patient. When the contemplated operation has a rather high mortality, the family should be advised of it, and the facts may or may not be made known to the patient, depending upon the circumstances.

When a sterilizing operation is contemplated, such as bilateral salpingectomy, hysterectomy or a pelvic operation with complete ablation of the ovaries, the possibility should be discussed openly with the patient. The attitude of women toward the loss of any of their sexual organs is quite variable. Not infrequently a woman will regard the loss of her uterus as a good riddance, if it has been the source of trouble to her for a long time. More often women forfeit any of their pelvic organs very reluctantly, and many young women look upon a sterilizing operation as a major catastrophe. When radical ovarian surgery becomes necessary, the surgeon should not regard it lightly. It is far better to assume a serious, sympathetic and yet encouraging attitude. The patient may be honestly assured that the symptoms of surgical menopause may be greatly allayed by estrogenic therapy, and the menopause of today is not to be dreaded as it was three decades ago.

Some women attempt to exact a promise from their surgeon that he will not, under any circumstances, remove certain organs. It is our custom never to operate under such restrictions, for if one does, sooner or later, one will encounter difficulties. Even with the most complete preoperative investigation, occasionally unsuspected conditions will be encountered which should be handled according to the best judgment of the surgeon at the operating table, unhampered by preoperative promises of conservatism. The surgeon can safely tell the patient that he is a firm believer in conservative pelvic surgery, when indicated, and that he will be conservative if this is compatible with cure. Further promises should not be made.

Closing the door to the possibility of future pregnancy naturally upsets many otherwise stable young women. This is usually due to real disappointment in being unable to have children, but not infrequently there

is confusion in their minds about their ability to carry on satisfactory marital relations following removal of certain pelvic organs. They should be comforted with the thought that matrimony need not be given up and should be told that there is no reason why marital relations may not be normal after most gynecologic operations. The possibility of adopting children should be held out to them; any experienced gynecologist or social worker can cite many homes that have been made happy by successful adoptions.

Little can be gained by performing a technically perfect operation if the patient lives in remorse for the rest of her life after she awakens to a realization of what has been done. It is far better to talk over the situation frankly with the woman before operation, let her fight it out with herself and then present herself in a receptive frame of mind for the operation. Subsequently, she will be able to adjust herself much more easily and, incidentally, she will think more kindly of her surgeon for having gone into the matter fully, preoperatively, rather than brutally telling her of the accomplished deed. Even on public ward services these practices should not be neglected.

As soon as the patient has been impressed with the necessity of the operation and she has given her consent, it is generally well to make hospital arrangements without much delay. If the operation is of an emergency nature, the patient should be informed of it, and the surgery should be done immediately. Also, even when the condition constitutes no real emergency it is better not to procrastinate too long. To some individuals the anticipation of surgery is worse than the realization. If the operation is postponed, the patient probably will discuss it with family and friends who often, unthinkingly, tell the patient of all the bad surgical results of which they have heard. A woman in whom only a hysterectomy is contemplated may be told of the tragedy of an artificial menopause brought on by a "hysterectomy" upon a friend. The fact that in the case of the friend a bilateral oophorectomy was done is probably not even recognized, but the tale will do an equal amount of damage to the nervous system of the prospective patient. Delay only heightens the patient's anxiety; when

the job is inevitable, it is better to proceed with it as soon as possible.

Occasionally, patients are encountered who, in spite of urgent necessity of surgical care, flatly refuse an operation. Such patients and their families should be given the facts and the surgeon's recommendations in plain language, although they should not be "talked into" the operation. In our experience, such patients almost always return for operation after a family conference, and sometimes after having obtained confirmatory surgical opinions from other doctors. If necessary, public ward patients should be followed by a social service worker.

### PREPARATION OF PATIENT FOR OPERATION

The patient should enter the hospital on the afternoon preceding the contemplated operation. This makes it possible for the house staff to take a history, to perform a physical examination and to do the routine laboratory work by early evening. After these routine things have been done, the patient should be encouraged to retire early. Patients often are quite apprehensive on entering the hospital, and the nurses and the house staff should do everything possible to make the transition from civilian to hospital life as pleasant to the patient as possible.

On admission, the receiving nurse obtains the necessary data for the hospital records, such as the complete name, the correct address, age, religion, and the names of the closest relatives. She also takes and records temperature, pulse and respiratory rate, as well as weight and height. Ward patients are routinely required to bathe; with private patients it is assumed that they will bathe. The interne then proceeds with his task of taking a history and performing a physical examination. Routinely, a white blood count and a hematocrit determination are done. If abnormalities appear in the physical examination, the blood studies or the urinalysis, the interne should report them to the senior house officer or the attending doctor, depending upon the resident system in the hospital.

The evening meal on the day before operation should be light and easily digestible. The occasional request of private patients for a

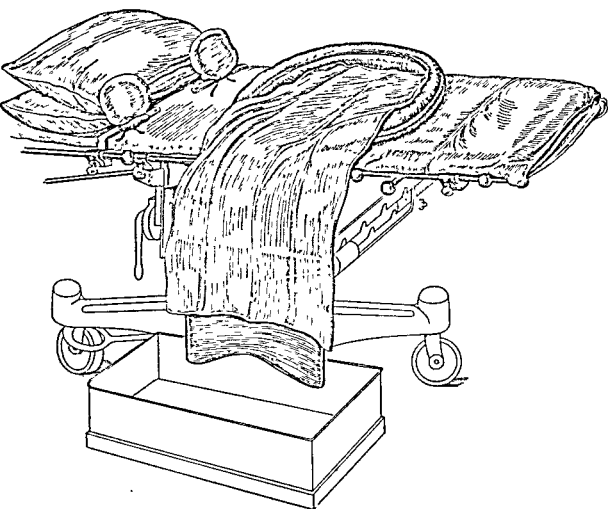


FIG. 2. Operating table setup for cleansing of vagina, preparatory to laparotomy.

leave of absence after entering the hospital, in order to celebrate with excessive food and/or drink on the eve of the operation, should be denied. Overloading of the alimentary tract shortly before operation is apt to increase postoperative discomfort from nausea and/or gas. The strenuous catharsis formerly used by many surgeons is unnecessary, but it is better to have the bowel relatively empty.

A good night's rest before operation is important. Relatives should be requested to leave at an early hour. Since the bed and the environment are new to the patient, and since there usually exists some apprehension about the impending operation, a mild sedative is advisable to ensure a good night's rest. We commonly use Seconal, Nembutal, Doriden or chloral hydrate in moderate dosage.

The patient should receive nothing by

mouth on the morning of operation unless the operation is posted for late in the day. In that case, a small amount of water is permitted, but not less than six hours preoperatively. It is desirable that the patient sleep as late as possible on the morning of the operation. The custom of awakening the patient at dawn to give an enema, when the operation is posted at noon, is most annoying to her, for after this awakening she becomes more apprehensive by the hour, waiting to be taken to the operating room. The preoperative soapsuds or Fleet's enema should be given 2 or 3 hours before the operation is scheduled.

Preoperative sedation is most important to the peace of mind of the patient and to the smoothness of the anesthesia. For major operations it is customary to give 61 Gm. of Seconal or Nembutal the night before the



operation is scheduled. On being called to the operating room, the patient is given 0.5 mg. of atropine sulfate and 10 to 12 mg. of morphine sulfate or 75 mg. of Demerol. For minor operations, it is customary to give only 0.5 mg. of atropine sulfate preoperatively, unless the nervous condition of the patient demands sedation.

Preoperative shaving of the patient may be done in the ward, but we prefer to shave her in the anesthesia room while the induction progresses. This does not increase the anesthesia time and releases the patient from the embarrassment and discomfort of shaving while awake.

### PREOPERATIVE PROCEDURES ON OPERATING-ROOM FLOOR

The patient is brought to the operating room floor in her bed. She is transferred to the operating table in the anesthesia room, adjoining the operating room. The operating table is previously prepared for laparotomy by placing a Kelly pad transversely on the table, so that liquids used for the vaginal cleanup will drain into a floor basin (Fig. 2). The patient is shaved by a nurse in the anesthesia room after the induction of the anesthesia. Since several minutes are required to attain surgical anesthesia, no anesthesia time is lost as a result of shaving while the patient is unconscious.

The patient is requested to empty her bladder before coming to the operating room, but catheterization is done routinely after she is anesthetized, except before the operation of dilatation and curettage. Even in these minor cases catheterization is done frequently in order to do a satisfactory examination under anesthesia. The technic of catheterization under anesthesia is the simplest. The labia are spread with the fingers of one hand, and the region of the urethral meatus is washed with a gauze sponge saturated with liquid soap. The region is then flushed with 70 per cent alcohol. The urethral meatus and the outer portion of the urethra are swabbed with a toothpick swab saturated with 1 per cent Zephiran. Then the catheter is passed. It is a good plan to press gently the base of the bladder per vaginam to ensure its complete emptying. It is also a good plan to press gently on the urethra with a vaginal

finger as the catheter is withdrawn to prevent the in-rush of air.

After shaving and catheterization, the patient is usually sufficiently anesthetized for a careful bimanual examination. We make examination under anesthesia a matter of absolute routine. Usually, it is simply confirmatory of the previous examination, but occasionally very valuable data are obtained, useful to the operator.

Following the vaginal examination, the perineum and the vagina are cleaned in the anesthesia room before all pelvic laparotomies. There is always the possibility that the findings at operation may make a total abdominal hysterectomy advisable, even when the preconceived plan in the operator's mind does not call for such an extensive procedure. It is extremely awkward to be caught with the necessity of a total hysterectomy at operation without having the vagina properly prepared. To prevent this, we have made preoperative vaginal cleanup a routine procedure. To clean the perineum and the vagina, the surgical assistant first scrubs the vulva and the perineum with a soapy sponge in his gloved hand. Then the vagina is scrubbed with a soapy sponge held in the fingers. By spreading the fingers, the outlet is enlarged, and the perineum is depressed to permit the soapy water to run out of the vagina. This is flushed away with sterile water poured by the nurse. From this point on, the cleanup is done with a sterile sponge on a sterile sponge stick. As successive sterile sponges are used, they are handed to the surgical assistant by the nurse. After the soap-and-water cleansing, the vagina, the vulva and the perineum are scrubbed with 70 per cent alcohol. Next, the vagina is swabbed with Scott's solution, and an unfolded sterile sponge is inserted in the vagina. The end of this is left protruding from the outlet, and the sponge stick is left attached to facilitate its removal during the operation. The sponge absorbs any secretions that may come from the cervical canal as the result of operative manipulation. At operation, the sponge is removed by a nurse who pulls on the sponge stick just before the vagina is opened.

After the vaginal cleanup, the abdomen is washed with ether, and particular attention is paid to cleansing the umbilicus with a

toothpick swab. A clean towel is thrown over the abdomen, and the patient is wheeled into the operating room. This towel is removed after the operating table is in position in the operating room, and the abdomen is cleaned up with a sterile sponge on a sponge stick, first making two applications of 70

per cent alcohol. This is followed with a saturated ether sponge to remove any film of grease on the skin. Next, the dry skin is painted twice with a sterile sponge, saturated with Metaphen (1 to 200). The painting of the abdomen is done in such a manner as always to progress from the clean to the un-



FIG. 3. Patient in Trendelenburg position, showing operative field and instrument tray.

operation is scheduled. On being called to the operating room, the patient is given 0.5 mg. of atropine sulfate and 10 to 12 mg. of morphine sulfate or 75 mg. of Demerol. For minor operations, it is customary to give only 0.5 mg. of atropine sulfate preoperatively, unless the nervous condition of the patient demands sedation.

Preoperative shaving of the patient may be done in the ward, but we prefer to shave her in the anesthesia room while the induction progresses. This does not increase the anesthesia time and releases the patient from the embarrassment and discomfort of shaving while awake.

### PREOPERATIVE PROCEDURES ON OPERATING-ROOM FLOOR

The patient is brought to the operating room floor in her bed. She is transferred to the operating table in the anesthesia room, adjoining the operating room. The operating table is previously prepared for laparotomy by placing a Kelly pad transversely on the table, so that liquids used for the vaginal cleanup will drain into a floor basin (Fig. 2). The patient is shaved by a nurse in the anesthesia room after the induction of the anesthesia. Since several minutes are required to attain surgical anesthesia, no anesthesia time is lost as a result of shaving while the patient is unconscious.

The patient is requested to empty her bladder before coming to the operating room, but catheterization is done routinely after she is anesthetized, except before the operation of dilatation and curettage. Even in these minor cases catheterization is done frequently in order to do a satisfactory examination under anesthesia. The technic of catheterization under anesthesia is the simplest. The labia are spread with the fingers of one hand, and the region of the urethral meatus is washed with a gauze sponge saturated with liquid soap. The region is then flushed with 70 per cent alcohol. The urethral meatus and the outer portion of the urethra are swabbed with a toothpick swab saturated with 1 per cent Zephiran. Then the catheter is passed. It is a good plan to press gently the base of the bladder per vaginam to ensure its complete emptying. It is also a good plan to press gently on the urethra with a vaginal

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After the vaginal cleanup, the abdomen is washed with ether, and particular attention is paid to cleansing the umbilicus with a

## PREOPERATIVE MEDICAL COMPLICATIONS

Almost any medical condition may be present in patients on whom gynecologic surgery is indicated. In such cases one should evaluate the seriousness of the gynecologic condition, the urgency of surgery and the risk of surgery in the presence of the medical complication. The final decision for or against surgery is based on careful consideration of all these factors. The more urgent the need

for surgery, the greater risk one is justified in taking by operating in the presence of a complication that would be an absolute contraindication for a less serious condition.

Respiratory disease of an acute or chronic nature is one of the most common complications occurring in patients upon whom gynecologic surgery is contemplated. Acute rhinitis and pharyngitis are absolute contraindications to elective surgery. At least a week should elapse after the cold has been cured

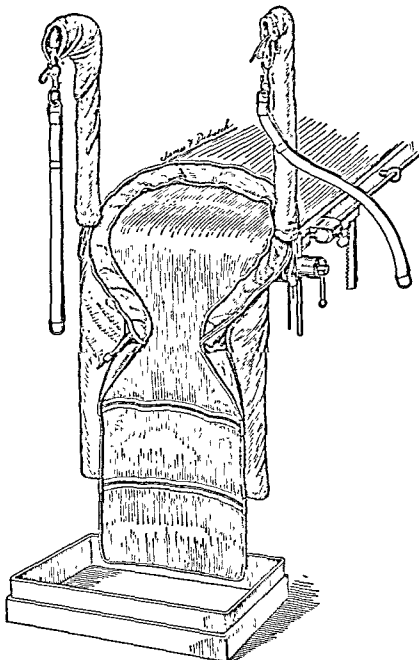


FIG. 5. Operating table prepared for perineal cleanup.



FIG. 6. First step in draping patient in lithotomy position. A longitudinally folded towel is held in position with narrow strip of adhesive to cover the anus.

before elective surgery is permitted. When it is relatively urgent to undertake the surgery, the respiratory passages can be put into more nearly normal condition by the use of sprays, gargles and inhalations of menthol in alcohol or benzoin. One of the commonest complaints of nervous patients on entering the hospital for gynecologic surgery is an irritation or "scratchiness" of the throat or a sense of obstruction in the nose. One hesitates to perform an elective operation on a patient who has even a suspicion of a respiratory infection; yet if one took such complaints too seriously one would be forced to cancel a substantial proportion of scheduled operations. The real condition of such patients should be evaluated after examination of the nose, the throat and the chest and after taking the temperature. If nothing is found to substantiate the patient's claims, one may justifiably proceed with the surgery. If an emergency operation must be done in the presence of a cold, Pentothal Sodium is an excellent anesthetic. It is preferable to spinal anesthesia, which

carries a rather high incidence of postoperative respiratory complications. This is probably due to incomplete aeration of the lungs, dependent upon partial paralysis of accessory muscles of respiration. When emergency surgery must be done in the presence of an acute pulmonary condition, a combination of local anesthesia and a minimum of Pentothal Sodium can be used to advantage. It is true that a high percentage of postoperative pulmonary complications are reported after local anesthesia, but one must take into consideration that the anesthetic is chosen, in many instances, because a respiratory condition exists preoperatively. When pelvic surgery becomes necessary in the presence of active pulmonary tuberculosis, spinal anesthesia is the choice.

Secondary anemia is one of the commonest preoperative conditions encountered in gynecology, since many of the gynecologic conditions requiring surgery are associated with bleeding. When the bleeding is simply excessive at each menstrual period and the

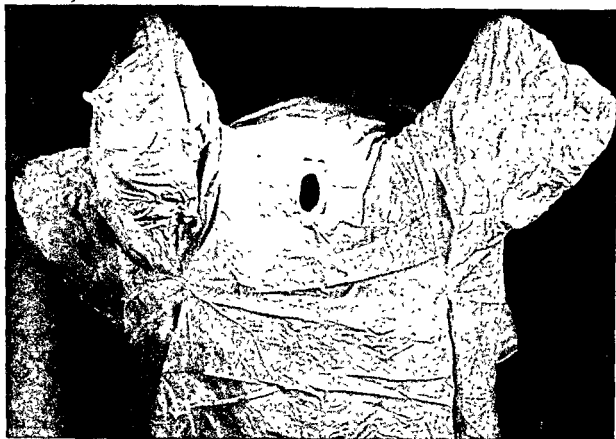


FIG. 7. Patient completely draped in lithotomy position with fenestrated towel and perineal sheet.

anemia is not too great, the operation may be timed to take place just before the expected date of the next menstruation. Iron preparations will help the patient to build up her hemoglobin. When anemia is severe, and especially in the presence of active bleeding, it is futile to attempt to treat the anemia medically. The red cell volume should be built up by as many transfusions as necessary before the operation. There is no doubt that mortality and morbidity are increased in patients low in red cell volume. There is no definite rule as to the hematocrit necessary before major surgery. The general condition of the patient and the magnitude of the contemplated operative procedure must also be considered. It is unwise to undertake even one of the less major operative procedures if the hematocrit is 30 or less. The greater the magnitude of the contemplated operation, the higher should the hematocrit be before surgery is undertaken. When operations are to be performed for large fibroids, severe

pelvic inflammatory disease, carcinoma of the cervix, uterine prolapse and other extensive major procedures the hematocrit should be built up by transfusion to at least 35, and blood should be matched and available for transfusions during and after operations. In fact, it is our routine practice to have at least 2 units of matched whole blood available prior to each major operative procedure.

Various degrees of hypertensive cardiovascular-renal disease are not uncommon in women in middle life when they so frequently require surgery for fibroids and uterine prolapse with its associated conditions of cystocele and rectocele. One of the commonest clinical pictures which we encounter, especially in the colored wards, is an obese middle-aged woman with a large symptomatic fibroid, considerable hypertension and evidence of beginning myocardial failure. Such patients should be studied carefully from the viewpoint of renal function (phthalein test, serum urea nitrogen determination and in-

travenous urograms). They also should have electrocardiographic studies. On the whole we are inclined to take calculated operative risks with them after a short period of rest and indicated digitalization. If the fibroid is large, the pressure on the diaphragm is a detriment to cardiorespiratory function. It is common to note improvement in pulmonary function after removal of the tumor. Serious renal disease causes us to hesitate, but here, too, there may be improvement in kidney function after the removal of the pressure of the tumor on the ureters. On the other hand, unnecessary surgery on asymptomatic or slightly symptomatic fibroids or for other benign, minor, pelvic conditions in patients with impaired cardiac or renal function is evidence of poor surgical judgment. Hypertensive vascular disease of such severity that the patient has already suffered a cerebral accident is a contraindication to all surgery except that which is necessary to save life.

Uncomplicated, asymptomatic valvular disease of the heart is seldom a contraindication to necessary pelvic surgery. Rheumatic mitral disease is the most common lesion of this type encountered. If there is evidence of even beginning decompensation, the patient should be examined carefully by an internist, and his advice should be followed in pre-

operative digitalization and postoperative care. With aortic valvular disease due to sclerosis or syphilis, the patient is apt to be a much poorer risk, not only because of the cardiac condition but also because of vascular lesions elsewhere in the body, dependent upon the generalized disease. As in all medical preoperative complications, the risk of the operation in these patients must be considered and balanced against the risk of permitting them to keep the gynecologic lesion under consideration or treating it in a nonsurgical manner.

Obesity is a more frequent and more serious preoperative complication than undernutrition in this country. Often it is desirable to put the obese patient on a suitable reducing diet for several months before performing an elective gynecologic operation. All too often this is futile and one is forced to proceed with the surgery in the presence of excessive obesity. When malnutrition and vitamin deficiencies are encountered, the patient should be put on a diet of high caloric value, and suitable vitamins should be supplied. In fact, for all obscure medical complications the gynecologist should call on specialists to aid in evaluating and preparing the patient to make her the best possible candidate for surgery.

# Armamentarium



Every surgeon of experience has his own favorite instruments, and no doubt equally good work can be done with different tools by different men. In the course of years of active service in gynecologic surgery we have standardized our equipment and setup of instruments. With the hope that our experience will be useful to others, and particularly to the younger surgeons, we are listing here the instruments used routinely in the usual gynecologic operations.

## INSTRUMENTS FOR PELVIC LAPAROTOMIES

- 2 Heaney clamps
- 18 Large curved Ochsner clamps
- 18 small Kelly clamps
- 8 Straight Ochsner clamps
- 6 Long Kelly clamps
- 24 Halsted clamps
- 6 Allis clamps (mucosa clips)
- 4 Towel clips
- 2 Long ring forceps (Fig. 9)
- 1 Long Ferguson forceps (Fig. 10)
- 1 Medium mousetooth forceps
- 2 Short mousetooth forceps
- 1 Short smooth forceps
- 1 Straight Mayo scissors (Fig. 11)
- 3 Curved bisection or mesoforceps (Fig. 12)
- 1 Cullen uterine elevator
- 1 Doyens myoma screw
- 1 Wire cutter
- 1 Long blunt dissector (staphylorrhaphy) (Fig. 13)
- 1 Uterine sound
- 1 Silver probe
- 1 Large spoon
- 3 Assorted spatulae
- 3 Snap or Kelly needle holders (Fig. 14)
- 3 Mayo needle holders
- 2 Bard-Parker knife handles No. 4
- 1 Edebohl's double retractor (Fig. 15)

FIG. 8. Instrument table set up for pelvic laparotomy.



- 2 of each size (small, medium and large) appendix retractors
- 2 of each size (medium and large) abdominal retractors
- 2 Lateral retractors
- 2 Wide rake retractors, shallow
- 8 Large sponge sticks
- 5 Small sponge forceps
- 2 Babcock clamps (Fig. 16)
- 2 Mosquito clamps
- 6 Small Kocher clamps
- 4 Towel clips
- 1 Catgut stretcher

The table, set up with these instruments, is shown in Figure 8. Several of the more or less special instruments which we consider particularly useful are shown in Figures 9 to 16.

FIG. 11. Straight Mayo scissors, an excellent tool for routine abdominal and vaginal work.



VIEW FROM ABOVE

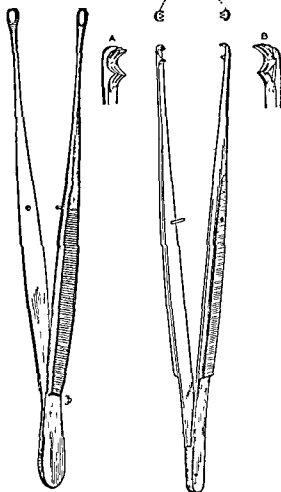


FIG. 9

FIG. 10

FIG. 12. Volsellum, useful for grasping uterus to prevent soiling peritoneum with uterine contents when performing subtotal abdominal hysterectomy. Also useful for controlling hemorrhage temporarily during bisection operation.

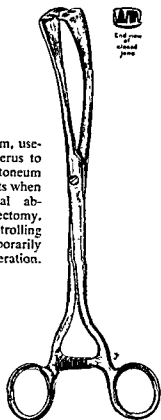


FIG. 9. Ring forceps, one of the indispensable instruments for pelvic laparotomy. The grooved ring end permits handling of bowel, omentum, tubes, bladder, etc., with a minimum of trauma.

FIG. 10. Long Ferguson forceps, especially useful for working on the cervix.

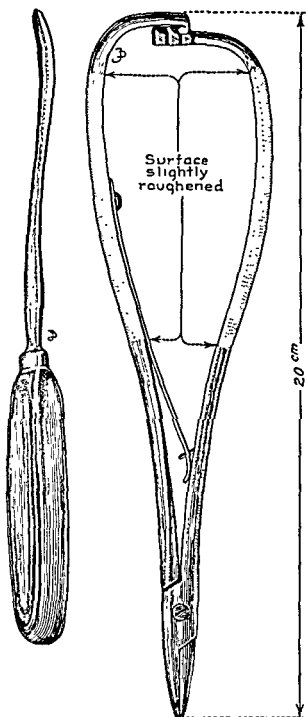


FIG. 13 (Left). Blunt dissector, useful for dissection in the region of large vessels, as in performing presacral neurectomies and pelvic gland dissections.

FIG. 14 (Right). Gynecologic needle holder, more convenient and more quickly manipulated than the usual needle holder.

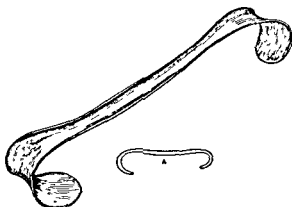


FIG. 15. Edebohl's retractor, a very useful instrument for exposing the fascia at the ends of the incision for beginning the fascia closure.

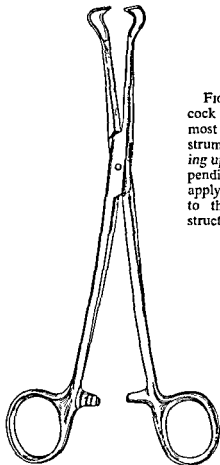


FIG. 16. Babcock clamp, a most useful instrument for picking up tube or appendix without applying pressure to these tubular structures.

INSTRUMENTS FOR  
VAGINAL REPAIR,  
VAGINAL HYSTERECTOMIES,  
TRANSPOSITION OPERATIONS,  
COMPOSITE OPERATIONS, ETC.

Vaginal retractors of various sizes

- 1 Pair Deaver retractors (Fig. 17)
- 2 Pairs small lateral retractors (Fig. 18)
- 1 Pair finger retractors (Fig. 19)
- 1 Uterine sound
- 3 Jacob's clamps

- 12 Small Kelly clamps
- 12 Halsted clamps
- 12 Allis clamps
- 12 Kocher clamps
- 6 Heaney clamps (Fig. 20)
- 3 Long Kelly clamps
- 3 Lahey thyroid clamps (Fig. 21)
- 1 Straight Mayo scissors

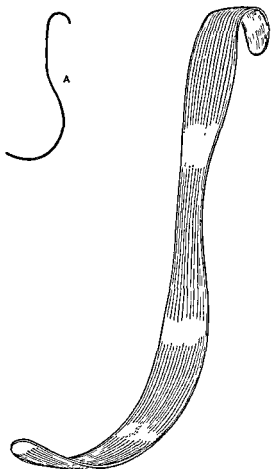


FIG. 17. Deaver retractor. Useful at laparotomy and at times in vaginal operations.

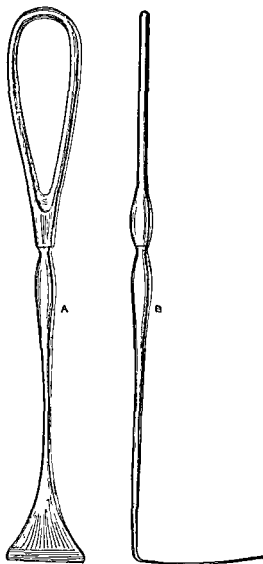


FIG. 18. Lateral vaginal retractor.

- 1 Curved Mayo scissors (Fig. 22)
- 2 Small mousetooth forceps
- 1 Small smooth forceps
- 1 Ring-tipped forceps
- 1 Short Ferguson forceps
- 3 Holden needle holders
- 3 Mayo needle holders
- 1 Glass catheter
- 1 Medicine catheter

- 1 Chetwood syringe
- Variety of catheters, both mushroom and French plain
- 2 Knife handles
- To this set add entire dilatation and curettage set.

The table set up with these instruments is shown in Figure 24. A few of the instruments which we consider especially useful are shown in Figures 17 to 22.

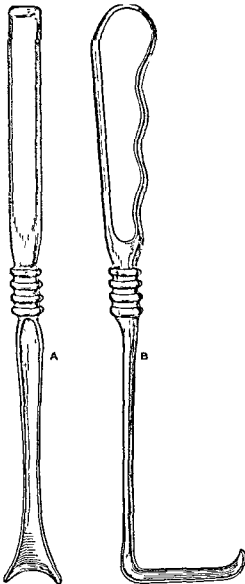


FIG. 19. Finger retractor, a most useful instrument for retracting the bladder when doing operations for prolapse and cystocele.

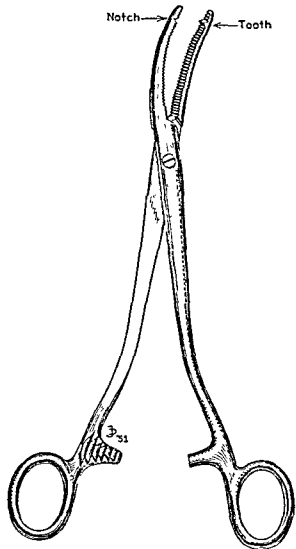


FIG. 20. Heaney clamp, an invaluable instrument for performing vaginal hysterectomy.

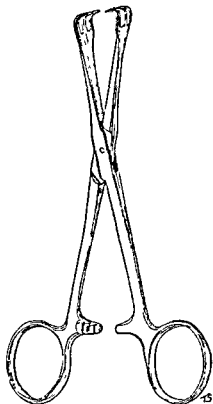


FIG. 21. Lahey thyroid clamp, a very useful instrument for delivering the uterus at vaginal hysterectomy.

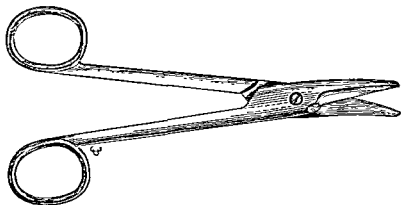
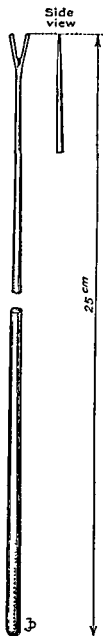


FIG. 22. Curved Mayo scissors, an instrument of great convenience in vaginal plastic work.

FIG. 23. Uterine packer, which permits packing of the uterine cavity with gauze and never clings to the gauze on withdrawal.



# INSTRUMENTS FOR DILATATION AND CURETTAGE

- 2 Goodell dilators
- 4 Hegar dilators
- 1 Uterine sound
- 1 Uterine packer (Fig. 23)
- 1 Silver probe
- 3 Serrated curettes, different sizes (Fig. 27)
- 1 Teaspoon
- 1 Jacob's clamp
- 1 Long Kelly clamp

- 1 Tenaculum
- 1 Posterior retractor (Fig. 25)
- 1 Anterior retractor
- 1 Biopsy forceps
- 1 Medicine cup for 3 or 4 cotton pledgets  
for alcohol on the cervix

The table setup with these instruments  
is shown in Figure 26.

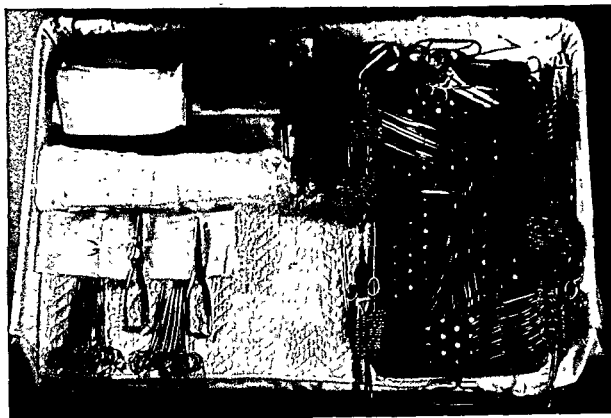


FIG. 24. Instrument table setup for perineal operation.

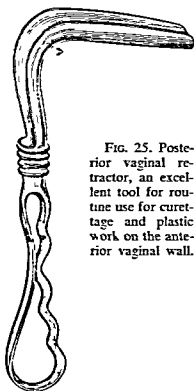


FIG. 25. Posterior vaginal retractor, an excellent tool for routine use for curettage and plastic work on the anterior vaginal wall.

### INSTRUMENTS FOR CERVICAL CAUTERIZATIONS

Dilatation and curettage set as above plus the following:

Scott's speculum (Fig. 28)

1 Bowl for saline

1 Cotton mitt for cautery

### INSTRUMENTS FOR RUBIN'S TEST

Dilatation and curettage set plus

1 Chetwood syringe

1 York claw holder (Fig. 29 B)

2 Rubin cannulae (Fig. 29 A)

1 Small bowl for saline

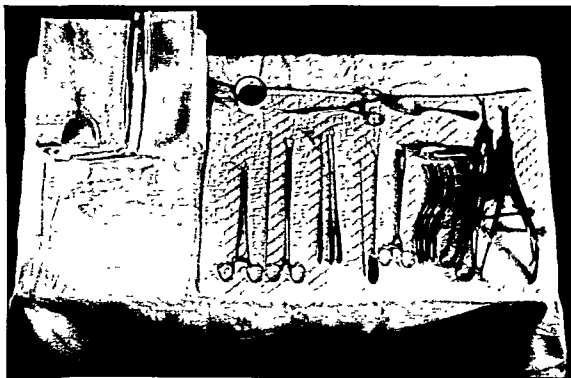


FIG. 26. Instrument table setup for dilatation and curettage.

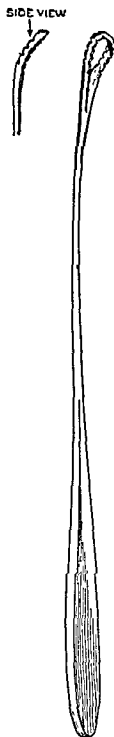


FIG. 27. Serrated curette for routine curettage.

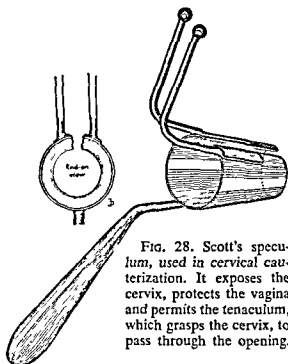


FIG. 28. Scott's speculum, used in cervical cauterization. It exposes the cervix, protects the vagina and permits the tenaculum, which grasps the cervix, to pass through the opening.

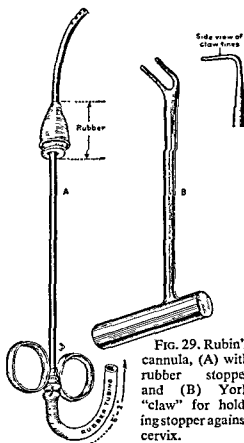


FIG. 29. Rubin's cannula, (A) with rubber stopper and (B) York "claw" for holding stopper against cervix.



# INSTRUMENTS FOR INSERTION OF RADIUM

Dilatation and curettage set plus the following:

- 1 Long needle holder with a reel of Pagenstecher and Martin No. 5 and No. 7 needles
- 1 Long mousetooth forceps
- 1 Long smooth forceps (Fig. 30)
- 1 Long straight scissors
- 1 Uterine sound
- 1 No. 14 mushroom catheter
- 1 No. 16 mushroom catheter
- 2 2" x 60" vaginal packs

FIG. 30. Large, rather broad forceps, an excellent instrument for inserting rubber tube containing radium into uterine cavity.

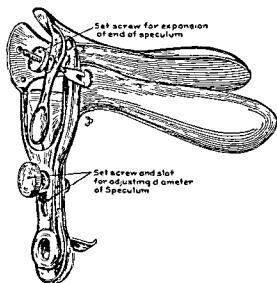


FIG. 31. Bivalve speculum.

# INSTRUMENTS FOR REMOVAL OF RADIUM

No sterile set up but have ready the following clean articles:

- 1 Vaginal bivalve speculum (Fig. 31)
- 1 Long mousetooth forceps
- 1 Long Kelly clamp
- 1 Long scissors
- Dressing basin
- Basin of alcohol back of lead plates for radium
- Keep in supply box on radium table ready for removal:
- Extra applicators and plaques for holding the radium
- Vaginal speculum
- Long Kelly clamp
- Long scissors
- Long forceps
- Rubber tubing, black
- White braided silk

### INSTRUMENTS FOR THERAPEUTIC ABORTION OR COMPLETION OF ABORTION

Dilatation and curettage set plus the following:

Placenta forceps, Kelly's (Fig. 32)  
Blake double-end curette (Fig. 33)  
Thomas blunt curette (Fig. 34)  
Hegar dilators, up to No. 16

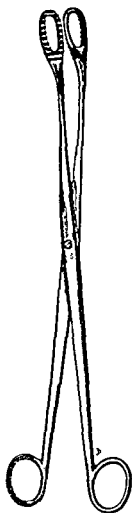


FIG. 32

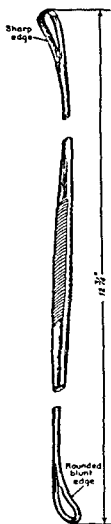


FIG. 33

FIG. 32. Placenta forceps. Useful for removing the products of conception.

FIG. 33. Blake double-end curette. An excellent instrument for removing products of conception.

FIG. 34. Smooth Thomas curette. For removing products of conception.



FIG. 34

### INSTRUMENTS FOR POSTERIOR COLPOTOMY

- 1 Posterior retractor
- 1 Jacob's clamp
- 1 Long Kelly clamp
- 1 Long Mayo scissors
- 1 Uterine sound
- 1 Long forceps
- 1 Culture tube
- Cigarette drains as desired

# Anesthesia and Resuscitation

PETER SAFAR, M.D.\*

## INTRODUCTION

Anesthesia for gynecologic surgery offers few problems which are not also encountered in anesthesia for general surgery. Obviously, a text on the art and science of anesthesia and on the pharmacology of anesthetic drugs is beyond the scope of this chapter. An attempt is made to discuss only some basic concepts of anesthesia and resuscitation as they concern the gynecologic surgeon, the physician-anesthetist and the nurse-anesthetist, who need to appreciate each other's problems. Those who seek further knowledge in anesthesiology are referred to standard teaching texts.<sup>4, 10, 24</sup> Knowledge of anesthesia gained only by reading does not qualify even a physician to administer an anesthetic. There is no substitute for practical experience obtained under adequate supervision.

Every anesthetic service should aim for the following: (1) optimal patient safety; (2) optimal working conditions for the surgeon; and (3) optimal patient comfort. Obtaining these goals in any given hospital depends on the organization of the department of anesthesia, which in turn is dependent on local circumstances.

Adequate supervision by a trained physician-anesthetist is a *sine qua non* for departments which employ nurse-anesthetists or maintain an anesthesia residency training program. The idea of having all anesthetics throughout the United States administered by trained physician-anesthetists probably will remain a utopia during our lifetime.

## MORTALITY

Patients in good physical status can tolerate a great deal of physiologic trespass,

while even a slight mistake may cause death in a patient in poor physical status. The mortality and the morbidity associated with anesthesia for gynecologic surgery is lower than that associated with anesthesia for general surgery. This may be explained by the fact that most gynecologic patients are in good physical condition. Nevertheless, deaths in which anesthesia is a primary or contributing factor do occur in connection with gynecologic surgery.<sup>2, 15</sup>

No particular anesthetic agent or technic appears to be the culprit. The primary cause of death associated with general anesthesia seems to be airway obstruction and/or respiratory depression. Fatal anesthetic overdose is relatively rare. The principal cause of death associated with spinal anesthesia is sudden uncontrolled hypotension.

Such tragedies due to simple mechanical asphyxia or hypotension can be averted by a rapid, skillful and effective resuscitative approach on the part of both the anesthetist and the surgeon.

Although the physician-anesthetist is personally responsible for anesthetic complications, we believe that the surgeon can help to minimize anesthetic mortality and morbidity as follows: (1) By demanding a well-trained anesthesia staff; (2) by requesting the anesthetist's participation in the preoperative evaluation of the patient, particularly if the patient is in poor physical status; (3) by not making the anesthetist use a technic with which he does not agree; (4) by not asking for unduly rapid induction and excessive muscular relaxation in patients in poor physical status.

## THE PREANESTHETIC VISIT

Adequate preanesthetic evaluation and preparation can prevent many difficulties in

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the operating room. This evaluation and preparation is the responsibility of the physician-anesthetist or, in circumstances when only nurse-anesthetists are available, the responsibility of the surgeon.

In reviewing the record of the history, the physical examination and the laboratory studies provided by the surgeon, the anesthetist should pay particular attention to the following: (1) evidence in history and physical examination of cardiopulmonary disturbance, low circulating blood volume (e.g., recent weight loss, malignancy, dehydration, blood loss) and systemic infection; (2) medications (e.g., insulin, steroids, antihypertensive drugs, digitalis); (3) laboratory findings.

The surgeon should inform the anesthetist about any problem which he thinks might influence the choice and the conduct of anesthesia. The anesthetist's evaluation of the patient's condition will influence the preanesthetic preparation, the final choice of the anesthetic, and the immediate postoperative care. If the anesthetist's final choice of anesthesia differs from the choice of anesthesia of the surgeon, a discussion should resolve the issue.

If at all possible, the anesthetist should see the patient the day prior to the operation in order to evaluate personally the physical status, to ask for any additional examinations that he may deem necessary, and to order the preanesthetic medication. If the anesthetist cannot see the patient personally the day prior to operation, the physician-anesthetist on night call should make the preanesthetic rounds the night prior to surgery and should transmit all necessary information to those responsible for the anesthesia.

Not only should the physician-anesthetist review the patient's hospital record and make necessary examinations, but he should also establish rapport with the patient in order to gain her confidence and to alleviate any apprehension.

## PREANESTHETIC MEDICATION

Preanesthetic orders should be written by the physician-anesthetist or, at institutions having only nurse-anesthetists, by the sur-

geon. The orders should include both the discontinuance of food, drink and medication and the administration of the preanesthetic medication.

Food and drink should be discontinued at least by midnight prior to the day of elective surgery. As pain, fear, or narcotic drugs may delay emptying of the stomach for more than 12 hours, only a soft meal should be permitted the night before surgery. When the operation is scheduled for the afternoon, a breakfast of clear liquids may be permitted.

The preanesthetic medication should be considered part of the anesthetic, since the choice of one influences the choice of the other. The preanesthetic medication should be individualized, taking into consideration both the findings obtained during the preanesthetic visit and the planned anesthetic technic. Large doses of depressant drugs are to be avoided, as they may cause hypotension or unconsciousness, the latter of which may lead to airway obstruction preoperatively. Alleviating apprehension by gaining the patient's confidence and by explaining with well-chosen words what is to be expected, even though more time-consuming, is to be preferred to heavy sedation.

**Premedication for Adults.** The drugs employed for preanesthetic medication vary greatly in different institutions. The following medications are recommended for the average adult:

1. A *parasympatholytic* drug, as *atropine* or *scopolamine*, always should be employed prior to general anesthesia to prevent salivation. Atropine 0.6 mg. or scopolamine, 0.4 mg., is given intramuscularly about 60 minutes (30 to 120 min.) prior to the induction of anesthesia. If induction of anesthesia is delayed for more than 120 minutes following the injection of the belladonna drug, the injection should be repeated. When, in an emergency, it is given intravenously, the drying effect should not be expected until 5 to 10 minutes after the injection.

The advantages of scopolamine over atropine lie in its better drying effect and its ability to produce amnesia, which is helpful, particularly when analgesia alone is used. Before spinal anesthesia, however, atropine is to be preferred to scopolamine, as the latter

may make the patient un-co-operative. A belladonna drug may even be omitted prior to spinal anesthesia if the anesthetist feels certain that supplementation of spinal anesthesia with general anesthesia will not be necessary.

2. To alleviate apprehension a *hypnotic* drug, such as *pentobarbital* (Nembutal) or *secobarbital* (Seconal), 100 to 150 mg., is usually administered by the intramuscular route, together with either atropine or scopolamine. These short-acting barbiturates in the recommended doses are less depressant to respiration and circulation than narcotics. The use of barbiturates should be avoided in the very old debilitated patient or in the patient in shock, as such patients are prone to develop hypotension and respiratory depression from barbiturates.

3. *Narcotic* drugs, such as *morphine* or *meperidine* (Demerol), we do not recommend for routine use, because of their well-known side-effects, which include respiratory depression, airway obstruction due to unconsciousness, hypotension (particularly postural hypotension), nausea, constipation and urinary retention. Circulatory collapse has been described with the use of narcotics, particularly in the aged. Therefore, in all patients over 65 years (physical age) and in patients with low blood volume or severe arteriosclerosis, narcotics either should be avoided or, if used, should be employed with great caution. As a rule, narcotics should be reserved for patients in pain, for unusually apprehensive patients, and for reinforcing light anesthesia.

Narcotics should be avoided if deep anesthesia with cyclopropane or halothane (Fluothane) is planned and spontaneous respirations are desired. In contrast, premedication with a narcotic is desirable before nitrous oxide-muscle relaxant anesthesia to reinforce the analgesic effect of nitrous oxide, and since muscle relaxants necessitate the use of artificial positive pressure respiration anyway.

When used, the preanesthetic dose of *morphine* for an adult is 10 mg. (5 to 15 mg.) intramuscularly. A comparative dose of *meperidine* is 75 mg. (50 to 100 mg.). Either narcotic may be given, together with atropine 0.6 mg. or scopolamine, 0.4 mg. When

heavy sedation is desirable in a generally healthy adult, pentobarbital or secobarbital (100 mg.) may be added to the narcotic and the belladonna drug. When we use narcotics to reinforce very light anesthesia, we prefer giving repeated intravenous injections of 25 mg. of meperidine prior to induction of anesthesia until the desired degree of central nervous system depression is obtained.

**Premedication for Children.** In children scopolamine is preferred to atropine because of its amnesic effect. The dose of scopolamine ranges from 0.1 mg. in the newborn to 0.4 mg. in the teenager. In addition, pentobarbital (2 mg./Kg. body weight) is given intramuscularly. If the child is not disturbed, this combined dose of scopolamine and pentobarbital usually produces sleep within 30 to 60 minutes. Then the child is taken to the operating room, where, without awakening her, anesthesia is induced in bed with either cyclopropane or halothane (so-called "steal-induction").

**Route of Administration.** We do not recommend the oral or the rectal route for preanesthetic medication, as the variable rate of drug absorption makes the onset, the degree and the duration of action unpredictable. However, if a hypnotic or analgesic drug is indicated the evening before surgery, it may be given by mouth.

**New Drugs.** Recently, chlorpromazine (Thorazine), promethazine (Phenergan), tranquilizers, and combinations of narcotics with narcotic antagonists have been recommended for preanesthetic medication. There is little evidence, if any, that these drugs can provide better preanesthetic conditions with fewer side-effects than the "old-fashioned" medication described above. Actually, severe hypotension and excitement have been seen with some of these drugs. In the choice of premedicant drugs, experience with the dose-effect relationship of familiar drugs is a practical advantage that is more important than theoretical advantages of new drugs.

In the unusual case, in which the patient insists on being put to sleep in her room, intravenous thiopental (Pentothal Sodium) may be used, provided that the anesthetist is able to control laryngospasm, airway obstruction and apnea during transportation.

## POSTURE

**Supine Position.** Ulnar or radial nerve paralysis may occur if the arm is positioned carelessly. The arm should be placed on top of the table and held in position with a lifting sheet.

Stretch due to abduction of the arm beyond a 90° angle may cause brachial plexus paralysis, a hazardous complication, as the paralysis may be irreversible. The anesthetist can avoid excessive stretch of the brachial plexus by watching to see that the surgeon does not accidentally push the armboard cephalad. The stretch may also be minimized by pronating the arm.

Naturally, injury of the plexus from abduction of the arm is entirely avoided when both arms are placed alongside the patient. In this case the intravenous infusion can be secured by insertion of a plastic catheter through the needle. If an additional intravenous infusion is required in a patient whose trachea is intubated, the external jugular vein may be used. The needle should be withdrawn before the patient awakens, as movement of the head may cause injury.

**Trendelenburg Position.** The Trendelenburg (head-down) position is commonly used during gynecologic operations, particularly during laparotomies, in order to give better exposure of the pelvic organs. In order to compensate for poor anesthesia the surgeon often demands the steepest possible head-down position, which the anesthetist prefers to minimize because of its deleterious effects on respiration and circulation. The degree of head-down tilt required for optimal exposure depends largely on the degree of abdominal relaxation, and on the smoothness of the respiratory movements provided by the anesthetist. Therefore, moderate Trendelenburg position should be adequate with good anesthesia.

The deleterious effects of the steep Trendelenburg position are as follows: (1) The abdominal contents push the diaphragm cephalad and thus decrease the lung volume and impair pulmonary ventilation. Spontaneous diaphragmatic movements may become jerky in the steep Trendelenburg position, which defeats the original purpose of this position, namely, keeping the abdominal con-

tents out of the pelvis. Assisted and controlled respiration is always mandatory with steep Trendelenburg position, and, as compared with the level position, higher inflation pressures are required to move equal volumes of air.<sup>17</sup> (2) When the body weight of the patient is supported by a shoulder-brace, the brachial plexus is prone to injury by direct compression at the neck. When the arm is abducted in addition, the plexus may be unduly stretched over the head of the humerus. Therefore, a shoulder brace should never be used on the side of the abducted arm but if used, it should be placed over the acromion. (3) Pulmonary congestion may occur and harm a patient who is in border-line heart failure. (4) The increased jugular vein pressure may cause cerebrovascular engorgement and edema of the conjunctiva and the face, particularly in obese patients.

In the use of spinal anesthesia for laparotomies the steep Trendelenburg position should also be avoided because of discomfort and the difficulty of assisting respiration in the awake patient.

**Lithotomy Position.** The patient should be placed in the lithotomy position after induction of anesthesia. In positioning the legs in the stirrups care should be taken that nerves and veins are not compressed and that vessels are not kinked by excessive flexion at the knee. Paralysis of the peroneal nerve may be caused by the pressure of the knee supports.

If spinal anesthesia is chosen for operations in the lithotomy position, the anesthetic level should be above the first lumbar dermatome, since numbness of the legs is required for patient comfort.

**Prone and Culdoscopy Position.** In the prone (face-down) and the culdoscopy (knee-chest) positions, the face and the upper airways are poorly accessible, which makes maintenance of a patent airway difficult, if not impossible. Inflation of the lungs is also more difficult in these positions, since more of the patient's weight must be moved with each breath.<sup>17</sup> Observation of the patient's color and vital signs is difficult because of the awkwardness of the position and because the room is usually darkened. Therefore, before placing an anesthetized patient

into the culdoscopy position, a tracheal tube should be inserted, and respirations should be assisted or controlled throughout.

Spinal anesthesia or caudal anesthesia may also be employed for culdoscopies. However, a high anesthetic level is required, in order to block intra-abdominal discomfort. We prefer general endotracheal anesthesia for culdoscopies, since it allows for assistance of ventilation and spares the patient the discomfort and the embarrassment associated with this position.

Injury to the brachial plexus has been seen subsequent to the use of the culdoscopy position. This may be due to excessive elevation of the arms over the head plus the turning of the head sideways.

### GENERAL ANESTHESIA

**Induction.** The induction of anesthesia with the intravenous injection of thiopental (Pentothal Sodium) is most popular because of its rapidity and its pleasantness for the patient. However, the ease of administration of thiopental, the use of which is often associated with apnea, laryngospasm, bronchospasm and hypotension, makes the use of this drug hazardous in the hands of the inexperienced anesthetist.

Induction with cyclopropane or halothane (Fluothane), which may be equally smooth and rapid in skilled hands, is safer for the patient in poor physical status. Induction with the nitrous oxide-oxygen-ether sequence is slow but probably the safest in the hands of the inexperienced anesthetist, because

spontaneous respirations are stimulated and complete laryngospasm is rare.

**Maintenance of Anesthesia.** The technic chosen for the maintenance of anesthesia depends on the degree of muscular relaxation required. For extraperitoneal procedures (e.g., D & C, vaginal plastic) light anesthesia which provides unconsciousness, lack of movements, and regular spontaneous breathing is sufficient. Muscular relaxation is not required except for difficult pelvic examinations, where brief periods of complete muscular relaxation are best provided by the muscle relaxant, succinylcholine (Table 1). This obviously produces apnea requiring intermittent positive pressure ventilation.

In vaginal hysterectomies moderately deep anesthesia is usually required in order to avoid the extrusion of abdominal viscera through the vaginal incision when the pelvic peritoneum is open. This rarely necessitates the use of muscle relaxants.

In abdominal intraperitoneal procedures, however, maximal muscular relaxation and quiet respiratory movements are desirable, to provide optimal working conditions for the surgeon and to permit a smooth convalescence by minimizing surgical trauma to the abdominal viscera. Relaxation of the abdominal wall is best provided by the use of high concentrations of potent general anesthetics, by muscle relaxants, or by conduction anesthesia (spinal or epidural anesthesia). Quiet respiratory movements are best provided by assisted or controlled respirations.

Relaxation and quiet respiratory move-

TABLE 1 COMMONLY USED MUSCLE-RELAXANT DRUGS

DRUG	APPROX. APNEIC DOSE I.V.	APPROX. DURATION OF RESPIRATORY DEPRESSION	SIDE-EFFECTS
Succinylcholine (Anectine, Scoline)	0.5 mg./Kg.	2-5 min.	None
Decamethonium (C-10, Sincurine)	0.06 mg./Kg.	10-20 min.	None
Gallamine (Flaxedil)	1.5 mg./Kg.	15-25 min.	Tachycardia
D-tubocurarine	0.3 mg./Kg.	20-30 min.	Occasionally bronchoconstriction and hypotension

ments are particularly important during the opening and the closing of the peritoneum, during exploration of the abdominal cavity, during packing of the intestines and during placing of the retractors.

In the hands of the less-experienced anesthetist the safest anesthetic technic for laparotomies is probably deep ether-oxygen anesthesia with spontaneous respiration.

In lean patients the use of cyclopropane with control of respiration without muscle relaxants may produce adequate muscular relaxation and quiet respiratory movements without undue circulatory depression. As the arterial pressure is better maintained with cyclopropane than with other agents and as high concentrations of oxygen can be used with this drug, it is the anesthetic of choice in patients with coronary artery disease, low blood volume, anemia and shock.

The use of halothane (Fluothane) has gained wide acceptance recently. The advantages of halothane are: (1) recovery is more rapid than after the use of thiopental for long operations; (2) it has less tendency to cause laryngospasm than thiopental or cyclopropane; (3) it seems to produce less salivation and less postoperative nausea and vomiting than cyclopropane or ether; (4) it is non-flammable. However, high concentrations of halothane may produce profound hypotension. Therefore, halothane alone can rarely be used safely to produce adequate abdominal muscular relaxation. Its ideal use is as a reinforcing agent of nitrous oxide in the maintenance of light anesthesia with spontaneous respiration.

**Muscle Relaxants.** Muscle-relaxant drugs (i.e., curare and curariform drugs) block the transmission at the neuromuscular junction and thus produce depression or cessation of respiratory movements. This necessitates the use of assisted or controlled respiration. Therefore, only trained anesthetists should use these drugs.

The proper use of muscle relaxants avoids the circulatory and metabolic changes associated with the use of high concentrations of potent anesthetics, which otherwise would be necessary to provide muscular relaxation.

The most commonly used muscle relaxants are listed in Table 1. Since during ab-

dominal surgery rapid and complete paralysis may be required at times and may be unnecessary at other times we prefer succinylcholine, because of its rapid and short action. Succinylcholine, given either by continuous intravenous infusion or by intermittent intravenous injections permits titration of the neuromuscular block. Nevertheless, succinylcholine must be used with caution, since large total amounts (over 1 Gm. in an average adult) may lead to prolonged apnea or muscle weakness subsequent to surgery. This may be due to the accumulation of succinylcholine metabolites—themselves weak relaxants. Some anesthetists prefer to use long-acting relaxants such as *d*-tubocurarine or gallamine and to counteract the drug with prostigmine at the end of surgery. Atropine is injected intravenously prior to the injection of prostigmine, as prostigmine produces bronchoconstriction, hypotension, bradycardia and salivation. This atropine-prostigmine reversal of curare is not without hazards, particularly in the patient with cardiovascular disease.

At present the following anesthetic technic seems to be the one most widely employed by trained anesthetists around the world. Unconsciousness is induced by thiopental (Pentothal Sodium) and maintained with nitrous oxide; a muscle relaxant prevents movements and provides muscular relaxation and apnea; artificial intermittent positive pressure ventilation is maintained. Among the general anesthetics nitrous oxide with at least 20 to 25 per cent oxygen produces the least change in circulation, respiration and metabolism. Some anesthetists like to reinforce nitrous oxide with intravenous meperidine (Demerol) or thiopental (Pentothal Sodium) or with the inhalation of 0.5 to 2 per cent halothane (Fluothane). There is little evidence that such reinforcement is needed routinely. However, when reactive pupils or sweating indicate undesirable surgical reflexes, some reinforcement is usually added.

**Assisted and Controlled Respiration.** Exposure during laparotomies is sometimes difficult, due to inadequate muscular relaxation. Exaggerated, jerky, spontaneous diaphragmatic movements may increase exposure difficulty and may be more troublesome than the



lack of abdominal muscular relaxation. To avoid such diaphragmatic movements we prefer to use assisted or controlled respiration during laparotomies.

Assisted respiration is the augmentation of shallow spontaneous breaths by manual compression of the anesthetic bag; rate and rhythm of respiration are determined by the spontaneous respiration of the patient.

Controlled respiration is achieved by first assisting respiration until the patient becomes apneic and then by ventilating the lungs with intermittent positive pressure, either manually or with a respirator.<sup>11</sup> Producing controlled respiration in the classic sense relies upon passive hyperventilation to produce apnea by removing both the carbon dioxide stimulus to the respiratory center and the hypoxic stimulus to the chemoreceptors. Such hyperventilation seems to reduce the amount of anesthetic and relaxant required. To facilitate controlled respiration one or more of the following maneuvers is added to the respiratory alkalosis: (1) depression of the respiratory center by narcotics, cyclopropane or halothane; (2) weakening of the respiratory muscles by relaxants; and (3) fatigue of the pulmonary stretch receptors by the rhythmicity of positive pressure ventilation.

### TRACHEAL INTUBATION

Tracheal intubation is merely one of several maneuvers that the anesthetist uses for providing a patent airway and ensuring adequate pulmonary ventilation. The advantages of tracheal intubation are: (1) upper airway soft-tissue obstruction is by-passed; (2) laryngeal stridor or laryngospasm is prevented; (3) the lungs are protected from aspiration if gastric content is regurgitated; (4) gastric distention with intermittent positive pressure respiration is prevented, and thus the use of a mechanical respirator is facilitated; (5) tracheobronchial suctioning is facilitated.

In adults cuffed tracheal tubes are preferred because an inflated cuff provides protection of the lungs and prevention of air leakage during positive pressure respiration.

The principal reason for the almost routine use of tracheal intubation during prolonged major intraperitoneal surgery is to prevent laryngeal stridor, which is more likely to

occur with intraperitoneal stimulation under light anesthesia. Intubation always should be performed in the very obese patient who is to be operated upon in the Trendelenburg position and in any patient who is to be placed into the knee-chest (culdoscopy) position. Although a tracheal tube facilitates positive pressure respiration in the curarized patient, a skilled anesthetist should also be able to produce in the apneic patient adequate pulmonary ventilation with the use of a face mask and a pharyngeal airway.

While the extensive use of tracheal intubation has revolutionized anesthesia and saved many lives, the indiscriminate use of tracheal intubation may possibly cause harm. Complications associated with tracheal intubation are more common in the hands of the inexperienced anesthetist. The choice of a tube with too small a diameter, intubation of a bronchus or the esophagus, or a kink in the tube may produce airway obstruction. Traumatic intubation, the use of too large a tube, or the use of irritating lubricants very occasionally result in obstructive laryngeal edema or laryngeal granuloma. Trauma to the lips, the tongue, the teeth, the pharynx and the larynx may occur during attempts at intubation. Tachycardia and hypertension, which accompany intubation under light anesthesia, are usually harmless. Intubation is performed most commonly during apnea produced by succinylcholine. Intubation in apnea must be preceded by hyperventilation of the lungs with oxygen. Even then ventilation should not be interrupted for more than 60 seconds at a time. Prolonged and repeated unsuccessful attempts at tracheal intubation may lead to hypoxia and cardiac arrest; therefore, if an airway can be maintained without the use of a tracheal tube, unsuccessful intubation should not be pursued. Unrecognized esophageal intubation may lead to death. If there is any doubt as to ventilation after intubation, the tracheal tube should be removed and the patient ventilated by bag and mask.

Sore throat and hoarseness is a common minor complication following tracheal intubation. The incidence of sore throat is minimized by an atraumatic technic of intubation and avoidance of coughing and "bucking" once the tube is in place. The prolonged pres-

sure of a face mask during a long-lasting anesthetic may produce edema and dermatitis of the face, a more unpleasant condition than a slightly sore throat. In general, the advantages of tracheal intubation outweigh its disadvantages.

### THE HAZARDS OF THE FULL STOMACH

Inhalation of gastric content seems to account for about 20 per cent of all deaths due to anesthesia.<sup>6</sup>

Vomiting or regurgitation of gastric content, particularly in the absence of a protective laryngeal reflex, may lead to death by one of the following mechanisms: (1) respiratory obstruction and acute asphyxia from aspiration of large amounts of gastric content; (2) laryngospasm; (3) pneumonia, atelectasis or pulmonary abscesses from aspiration of even small amounts of gastric content.

Active vomiting may occur at any time during anesthesia, but it is most likely to occur in light anesthesia during induction or recovery. Passive regurgitation, which is more likely to go unnoticed, occurs usually when fullness of the stomach plus one of the following factors co-exist: increased intra-abdominal pressure (e.g., intraperitoneal hemorrhage, intestinal obstruction); a gastric tube, rendering the cardia incompetent; curarization with relaxation of the diaphragm; or the use of the head-down position. Emptying of the stomach is prolonged by pain, peritoneal irritation (peritonitis, twisted ovarian cyst), serious illness (septicemia, shock), or narcotics; and in a patient with intestinal obstruction or paralytic ileus.

Every attempt must be made to prevent aspiration of gastric content. Patients who presumably have a full stomach should never be anesthetized unless the postponement of surgery presents a greater risk. A patient who needs emergency surgery and is suspected of having a full stomach should have a large-bore gastric tube inserted prior to the induction of anesthesia in order to aspirate as much gastric content as possible. Nevertheless, the presence of a gastric tube does not mean that the stomach is empty, as the tube becomes blocked easily by food particles. The gastric tube may merely decompress the

stomach by allowing removal of some of the liquid and air, thus reducing the likelihood of regurgitation.

If a patient with a full stomach requires a perineal procedure, a spinal anesthetic is usually satisfactory. However, if a laparotomy is required, a spinal anesthetic would not necessarily be the best choice for the following reasons: (1) A high level of spinal anesthesia would be required, which, by paralyzing the expiratory muscles, would depress the protective cough. (2) Intraperitoneal stimulation often causes pushing or retching during spinal anesthesia. (3) Patients with hypovolemic shock, a contraindication for high spinal anesthesia. (4) Aspiration of vomitus may occur even under spinal anesthesia with the patient conscious, particularly in debilitated patients and when hypotension leads to nausea and vomiting. Therefore, we feel that in skilled hands general anesthesia with the use of a cuffed tracheal tube is safer for laparotomies in patients with full stomachs than is spinal anesthesia. When skilled personnel is not available, spinal anesthesia is probably preferable.

We prefer one of the following 2 techniques for tracheal intubation and induction of general anesthesia when a full stomach is suspected:

1. *Intubation Following Topical Anesthesia of the Upper Airways.* With the patient conscious, the pharynx is anesthetized by spraying, and the larynx by spraying or trans-laryngeal injection of a topical anesthetic. A tracheal tube is then inserted through the mouth with the help of a laryngoscope, and the cuff is inflated. General anesthesia is induced with thiopental or cyclopropane. With some practice this technic causes little discomfort to the patient.

2. *Intubation in the Flexed Semisitting Position Following General Anesthesia and Full Paralysis.* The semisitting position alone counteracts passive regurgitation. In addition, the feet are elevated to prevent postural hypotension. After the patient is positioned the lungs are denitrogenated by having the patient inhale 100 per cent oxygen for 2 minutes either from a nonrebreathing system or from a circle system with a high flow of oxygen. This preliminary denitrogenation is

done to permit intubation during apnea without the danger of hypoxia. After denitrogenation unconsciousness is induced with small amounts of thiopental injected intravenously, or with cyclopropane. As soon as unconsciousness ensues the patient is completely paralyzed with the intravenous injection of a large dose of succinylcholine. The patient is apneic and flaccid usually within 30 seconds after the injection of succinylcholine. At this point the face mask is removed, the trachea is swiftly intubated, the cuff inflated, and the lungs ventilated with positive pressure respiration. Complete paralysis for intubation is necessary to prevent retching movements. Positive pressure inflation of the lungs prior to intubation and at the onset of apnea should be avoided, as some of the air may be pushed into the stomach, enhancing the likelihood of regurgitation. Anesthesia is then maintained by any suitable technic.

Both methods mentioned above require skill. The first technic is probably safer; the second is more pleasant for the patient.

*Vomiting* in the unconscious patient in the absence of a tracheal tube calls for judgment and rapid action. Often aspiration may be prevented by swiftly placing the patient into the steep Trendelenburg position, turning her face to the side and wiping and suctioning the pharynx clean. When the patient is cyanotic, no time is to be wasted attempting to suction the airway. Rather, oxygen must be forced into the lungs as rapidly as possible, using any available method. In the cyanotic patient, suctioning or tracheal intubation should be attempted only after attempts at inflating the lungs have failed.

If after vomiting the lungs do not sound clear upon auscultation, the trachea should be intubated. Intubation is done preferably without the use of a muscle relaxant in order to retain the cough reflex. The tracheobronchial tree should then be suctioned with a large-bore catheter inserted through the tracheal tube. The use of a curved Tieman catheter permits insertion into the bronchi. To dilute any acid gastric content present, *tracheobronchial suctioning* should be accompanied by repeated instillation of physiologic saline solution into the lungs; 10 ml. at a time is recommended. During tracheo-

bronchial suctioning hypoxia must be avoided by intermittent inflation of the lungs with oxygen. If vomiting occurs during the induction of anesthesia and there is evidence of aspiration of solid particles, elective surgery should be postponed.

Bronchoscopy is not a resuscitative procedure. It is indicated whenever there is evidence of aspiration of solid particles and/or clinical or x-ray evidence of massive atelectasis. In the presence of only patchy atelectasis coughing, tracheobronchial suctioning and saline instillation, as described above, together with the prophylactic use of antibiotics and steroids (anti-inflammatory action) usually clear the lungs and do not require bronchoscopic aspiration.

## FIRE AND EXPLOSION HAZARDS<sup>12</sup>

Death from anesthetic explosions is estimated to occur in 1 of 1 million anesthetics.

A fire or explosion may occur whenever there is present both a combustible material (ether, cyclopropane, ethylene, vinethene, ethylchloride) and oxygen or nitrous oxide for the support of combustion. The flammability of ether in anesthetic concentrations is about as great as that of cyclopropane. Cyclopropane merely explodes with greater force.

Obvious sources of ignition are open sparks and open flames. A less obvious ignition source is the static spark. If two objects with different electrical potential approximate, a spark may occur. The grounding of personnel and of objects prevents the development of these different electrical potentials.

More important than expensive spark-proof equipment is the discipline of the operating room personnel. Personnel in the anesthetizing area should wear conductive shoes. Blankets and clothes of wool or nylon should be prohibited in the operating room. The floors, the operating tables and the mattresses should be conductive or grounded with wet towels before starting anesthesia. Persons other than the anesthetist should not touch the anesthetic machine or the patient at a site close to the airway. Physical contact should be made at a distance from the combustible agent. Cautery and other electrical equipment should not be turned on without

the permission of the anesthetist. For removal of combustible fumes the operating room should be adequately ventilated.

Anesthetics which may be used safely in the presence of electrical equipment are intravenous drugs, nitrous oxide, halothane, chloroform and trichlorethylene. If the anesthetist feels that the advantage of the high oxygen concentration with cyclopropane or ether outweighs the risk of an explosion, these flammable agents may be used even with electrocautery, provided that the source of ignition is kept at least 2 feet from the patient's airway, with a screen of wet towels between.

The introduction of halothane (Fluothane) has greatly reduced the need for flammable anesthetics.

### SPINAL ANESTHESIA<sup>4</sup>

Almost all gynecologic operations can be performed safely under spinal anesthesia. In hospitals without trained anesthetists the routine use of spinal anesthesia for gynecologic surgery is probably safer than the routine use of general anesthesia, provided that the surgeon who gives the spinal anesthetic is experienced not only in the performance of lumbar puncture, but also in the management of the patient following subarachnoid injection. Therefore, every gynecologic surgeon should be thoroughly trained in this technic.

Some patients seem to be more afraid of paralysis from spinal anesthesia than of death from general anesthesia. Therefore, we do not recommend the use of spinal anesthesia in patients who feel strongly against its use. The patient is persuaded to agree to a spinal anesthetic only if a general anesthetic would represent a greater hazard.

The poor reputation which spinal anesthesia has gained in some parts of the world is undeserved and is due primarily to indiscriminate use, which has caused (1) major neurologic complications and (2) sudden death following subarachnoid injection.

**Prevention of Major Neurologic Complications.** In 1950 Foster Kennedy stated that "paralysis below the waist is too large a price for a patient to pay in order that the surgeon should have a fine, relaxed field." Since then careful follow-up studies by Dripps and

Vandam<sup>5, 23</sup> and other investigators of several thousand patients who had spinal anesthesia have shown clearly that serious neurologic sequelae can be avoided provided that equipment is prepared properly and an atraumatic technic is used. Meningitis was not seen in the 10,000 cases reported by Dripps and Vandam.

Cases of adhesive arachnoiditis and myelitis seem to have been due to subarachnoid injection of irritating substances other than the local anesthetic. This can be avoided by meticulous cleaning of the equipment, by careful technic, and by abandoning the habit of soaking ampules in antiseptic solutions, as an invisible crack may permit contamination of an ampule with the antiseptic. During the presence of paresthesia following lumbar puncture the drug should never be injected, since the needle may have been inserted into a nerve root, and intraneural injection may damage the spinal cord.

**Prevention of Sudden Death.** The subarachnoid injection of a local anesthetic may lead to sudden hypotension and respiratory arrest, a complication which can be avoided with correct technic. Spinal anesthesia is contraindicated in patients in hypovolemic shock.

The spinal anesthetic block causes vasodilatation, which in turn leads to pooling of blood into the anesthetized and dependent areas of the body, and thus hampers the venous return to the heart. The resulting hypotension may cause cerebral ischemia and thus respiratory arrest. Apnea caused by a rise of the motor block to the 4th cervical segment (i.e., the phrenic nerve) is very unlikely with the use of conventional techniques and the dosages listed in Table 2.

Since hypoxia and hypotension are the principal hazards of spinal anesthesia oxygen is given by a light plastic face mask, whenever possible, and the blood pressure is checked frequently. Hypotension occurs most commonly following movement of the patient from the lumbar puncture position to the operating position. Therefore, this movement should be performed gradually and cautiously. In an attempt to prevent hypotension the legs should be elevated immediately following subarachnoid injection. A flexed position is obtained, when, in addition,

TABLE 2. SPINAL ANESTHESIA WITH HYPERBARIC TETRACAINE  
Tetracaine (Pontocaine) 1%, Plus Dextrose 10%, in Equal Amounts; Epinephrine  
0.5 mg. Added for Anesthesia Over 1½ Hours

SITE OF OPERATION	POSITION FOR OPERATION	POSITION FOR INJECTION	ANESTHESIA LEVEL REQUIRED*	APPROX. DOSE OF TETRACAINE†
Anus	Jackknife-prone	Sitting 5-10 min.	S. 1	5 mg.
Anus, Vulva	Lithotomy	Sitting 30 sec.	Th. 12	10 mg.
D & C	Lithotomy	Sitting for injection only	Th. 8	12 mg.
Vaginal Hysterectomy	Lithotomy	Sitting for injection only	Th. 5	14 mg.
Laparotomy	Supine Trendelenburg	Lateral-horizontal for injection only	Th. 5	14 mg.

\* Xyphoid = Th. 5/6  
Umbilicus = Th. 10  
Symphysis = Th. 12/L1

† For patient 5 ft. 5 in. tall. If shorter, smaller dose. If taller, larger dose. If increased intra-abdominal pressure (e.g., full-term pregnancy) ½ to ¾ dose.

the shoulders are elevated to prevent a further rise of the anesthetic. After the anesthetic level has stabilized, approximately 15 to 20 minutes following the subarachnoid injection of tetracaine (Pontocaine)-dextrose, the patient may be placed into the desired position. If hypotension occurs, the legs never should be lowered in the mistaken belief that this would counteract hypotension by preventing a rise of the anesthetic level. On the contrary, the legs should be elevated to enhance venous return. Hypotension should be corrected promptly with the intravenous injection of a vasopressor (Table 3).

If the anesthetic level includes the splanchnic outflow (Th. 5), hypotension is more likely to occur. Also, the patient with low blood volume, essential hypertension, or arteriosclerosis is more prone to develop hypotension with spinal anesthesia.

The routine prophylactic injection of a vasopressor prior to the subarachnoid injection of an anesthetic is a matter of personal preference. However, prior to performing high spinal anesthesia, a prophylactic intramuscular injection of a vasopressor is advisable. Once hypotension occurs, a vasopressor should be injected intravenously for titration of the blood pressure.

**Postspinal-Anesthesia Headache.** Although

not a life-threatening condition, postspinal-anesthesia headache deters some people from the use of spinal anesthesia. Headache has been shown to be most likely due to low cerebrospinal fluid pressure secondary to loss of cerebrospinal fluid through the puncture hole, as the incidence of postspinal-anesthesia headache is higher following the use of a large-gauge needle than following the use of a small-gauge needle. The incidence of headache is also high in women, in young patients, in patients with increased intra-abdominal pressure (e.g., full-term pregnancy) and with early ambulation. The use of a 24-gauge needle can reduce the incidence of headache to between 1 and 6 per cent. We have been using 24-gauge lumbar puncture needles satisfactorily without the use of introducer needles.

Once headache occurs, the best treatment is the intravenous infusion of large amounts of fluid and the maintenance of the patient in the level position. Analgesics and narcotics may be given as needed. We have never found it necessary to inject saline solution into the epidural space in an attempt to increase subarachnoid pressure.

**Preparation of the Spinal Tray.** Not only sterility but also chemical cleanliness of syringes, needles and ampules is imperative.

All items, including the drugs, should be autoclaved on one tray, thus avoiding any subsequent addition of equipment to the tray.

Our spinal tray consists of the following: 1 cover towel; 1 drape with hole for the patient's back; 1 glass cup for the skin antiseptic; 1 syringe, 5 ml., plain tip, for the subarachnoid injection; 1 syringe, 2 ml., for local anesthesia of the skin and injection of a vasopressor; 1 needle, 18 gauge, for drawing the spinal anesthetic into the syringe; 1 hypodermic needle, 25 gauge, for skin anesthesia; 1 needle, 22 gauge, 2 inch, for the injection of the vasopressor; 1 lumbar puncture needle, 22 gauge, 3½ inch, with stylet; 1 lumbar puncture needle, 24 gauge, 3½ inch, with stylet; 1 introducer needle, 20 gauge, 2 inch, for easier insertion of the 24 gauge needle; 1 sponge forceps and 3 sponges for sterilizing the skin; 1 ampule file; 1 ampule, 2 ml., of tetracaine 1%; 1 ampule, 3 ml. of dextrose, 10%; 1 ampule of epinephrine 1:1000; 1 ampule of procaine 1% for anesthesia of the skin; 1 ampule, 1 ml. of the vasopressor methoxamine (Vasoxyl) 20 mg./ml.

Before autoclaving, needles and syringes are first cleaned with a detergent and then rinsed thoroughly with distilled water. All drugs should be in sealed ampules, prepared by reputable manufacturers, and should never be re-autoclaved. The spinal trays are autoclaved for 20 minutes at 200° F. and 27 lbs. pressure.

**Anesthetic Solution.** The type and the specific gravity of the anesthetic used depends on personal preference and experience. We are commonly using hyperbaric tetracaine (Pontocaine), i.e., 1 per cent tetracaine plus equal amounts of 10 per cent dextrose, which has a specific gravity of 1.024; the specific gravity of cerebrospinal fluid is 1.004-1.007. After injection of the dosages listed in Table 2, anesthesia of 1½ to 3 hours' duration can be expected. If anesthesia is desired for longer than 1½ hours, epinephrine (0.5 mg.) should be added to the tetracaine/dextrose solution. A larger amount of epinephrine should not be used because of the danger of producing ischemia of the spinal cord.

**Spinal Anesthetic Level.** The level of the autonomic and sensory block usually is slightly higher than that of the motor block,

due to drug diffusion. A higher concentration of anesthetic is required for blocking the thick motor fibers. For vaginal operations which do not include opening the peritoneal cavity, an anesthetic level at or above T8 is required, since autonomic afferent impulses from the pelvic organs enter the spinal cord to this level. For intraperitoneal procedures, both vaginal and abdominal, the block should include the splanchnic afferents, i.e., to the level of Th. 5. For laparotomies the motor block should be higher than for vaginal hysterectomies. Therefore, for laparotomies injection is performed in the lateral position, while for vaginal hysterectomies the injection is performed in the sitting position.

The spinal anesthetic level is influenced by (1) the dosage of the anesthetic (Table 2); (2) the specific gravity of the solution; (3) the length of the patient's vertebral column, i.e., the patient's height; (4) the rate of injection; (5) the volume injected; (6) the position of the patient during and immediately following injection; (7) the intra-abdominal pressure. Increased intra-abdominal pressure (ascites, large intraperitoneal tumors, obesity, full-term pregnancy, straining and coughing) may cause engorgement of the epidural veins, and thus narrowing of the subarachnoid space, which results in a higher anesthetic level. In full-term pregnancy the dose of tetracaine/dextrose should never exceed ⅔ of that listed in Table 2.

**Technic.** A discussion of spinal anesthesia technic is beyond the scope of this chapter. The person who never has given a spinal anesthetic should first study a standard text<sup>4,9,10</sup> and perform several spinal anesthetics under the close supervision of an experienced anesthetist. More difficult than the lumbar puncture itself is prevention of hypotension, retching and patient discomfort following the subarachnoid injection. Before the subarachnoid injection, a blood pressure cuff should always be applied, and an intravenous infusion should always be started so that a vasopressor may be given rapidly. Also, an anesthetic machine or bag-mask-oxygen unit should be at hand for control of respiration.

The anesthetist must wear sterile gloves, although a sterile handscrub is not neces-

sary. The contamination of syringes and needles with powder from the gloves, and the touching of the barrel of the syringe and the shaft of the lumbar puncture needle with the gloves, should be avoided. Bloody fluid is not a contraindication to injection, unless it does not clear. The first few minutes following the subarachnoid injection are the most critical. During this time the anesthetic level should be tested, and its rise controlled by correct positioning of the patient; the blood pressure should be checked repeatedly and maintained near normal; and the patient should be given oxygen, at least when the anesthetic level is high or the patient is in poor physical status.

A surgeon who injects a spinal anesthetic and leaves the patient unattended in order to perform the operation himself is negligent. If at all possible, the person who injects the anesthetic should attend the patient throughout the operation. If this is not possible, a trained nurse, who is familiar with resuscitation and with the use of vasopressors, may attend the patient after the anesthetic level has been established.

**Continuous Spinal Anesthesia.** This technique is rarely used now, as the addition of epinephrine to a single injection of tetracaine/dextrose provides anesthesia of 3 hours or more. The use of a large-bore needle, which is required for the insertion of a subarachnoid catheter, is associated with a high incidence of post-lumbar-puncture headache.

**Supplementation With General Anesthesia.** Autonomic pain due to visceral stimulation may be controlled by intravenous injections of small amounts of thiopental. Somatic pain occurring when the anesthetic level is too low requires either the intravenous injection of opiates or full supplementation with general anesthesia.

During major intra-abdominal surgery, even the best spinal block often does not prevent patient discomfort and retching movements, apparently due to impulses via vagal afferents. This is more pronounced with upper abdominal than with lower abdominal surgery. Therefore, in major laparotomies, we prefer to supplement spinal anesthesia from the beginning with light general anesthesia. Thiopental-nitrous oxide or nitrous oxide-cyclopropane are satisfactory, and

spontaneous respiration is retained. Smooth supplementation of spinal anesthesia is an art and should not be performed by the beginner without adequate supervision. The use of halothane, ether and controlled respirations may augment spinal anesthesia hypotension.

Spinal anesthesia supplemented with light general anesthesia may provide optimal working conditions for abdominal surgery: maximal abdominal relaxation, quiet spontaneous respiration, contracted intestines (leaving more room for the surgeon) and rapid recovery of consciousness.

### EPIDURAL AND CAUDAL ANESTHESIA

Epidural anesthesia is the introduction of a local anesthetic into the epidural space.

Caudal anesthesia is epidural anesthesia with the local anesthetic being injected through the sacral hiatus.

The advantage of caudal or epidural anesthesia over spinal anesthesia is the absence of headache due to lumbar puncture.

In contrast, the disadvantages of caudal and epidural anesthesia are: (1) they are less reliable, because of greater technical difficulty; (2) the onset of anesthesia is slower; (3) there is the possibility of hypotension or stimulation of the central nervous system following systemic absorption of the large amounts of local anesthetic required; (4) inadvertent subarachnoid puncture may produce total spinal block. The likelihood of producing hypotension due to sympathetic blockade is probably the same whether the block is epidural or subarachnoid, if the same nerve roots are blocked.

Caudal anesthesia is indicated for hemorrhoidectomies and minor vaginal operations, particularly in patients who have had headaches following previous lumbar punctures.

### LOCAL ANESTHESIA

The gynecologist may use infiltration anesthesia for minor superficial surgery on the external genitalia; he uses topical anesthesia for cystoscopic work. The most commonly used infiltration anesthetics are procaine (Novocain) and lidocaine (Xylocaine). The most commonly used topical anesthetics are tetracaine (Pontocaine) and lidocaine. Many

other local anesthetics are equally satisfactory if the anesthetist is familiar with their pharmacology and toxicity.

Lidocaine, although more expensive than procaine, is now the preferred drug for infiltration anesthesia because of its more rapid onset of action, longer duration and greater diffusibility. Lidocaine is used in 0.5 per cent concentration for infiltration anesthesia, in 1 per cent concentration for blocking small nerves (e.g., pudendal nerve) and in 2 per cent concentration for blocking thick motor nerves. Even with slow injection a total amount of 500 to 750 mg. of lidocaine should not be exceeded.

For topical anesthesia lidocaine is used in 2 to 5 per cent solution or tetracaine in 1 to 2 per cent solution. A total amount of 40 mg. of tetracaine should not be exceeded.

### HYPOTENSION DURING ANESTHESIA

Hypotension during anesthesia is commonly caused by one or a combination of the following factors: (1) blood loss; (2) overdose with anesthetics; and (3) reflexes from surgical stimuli.

**Blood Loss.** Even the experienced surgeon may underestimate the amount of blood loss during gynecologic operations.

Therefore, in teaching hospitals it is occasionally advisable to measure blood loss by weighing sponges and measuring blood in the suction bottle.<sup>1</sup> This gravimetric technic of blood loss measurement can be applied any time if dry sponges of known weight are used routinely. With the use of moist sponges gravimetric measurement of blood loss, although less accurate, is also possible, if the nurse measures the amount of saline solution used for moistening the sponges, provided that spilling of the solution is avoided. Colorimetric technics of blood loss measurement require special equipment and do not give results as readily as the gravimetric technic.

Naturally, measurement of circulating blood volume before, during and after surgery would be most helpful. Unfortunately, the more reliable technics available at present (measurement of the dilution of injected radioactive chromium-tagged red cells or radioactive-iodine tagged serum albumine)

are technics which require expensive equipment and special personnel, so that their routine clinical use is hardly justified.

Arterial hypotension, tachycardia, constricted veins, clammy skin and pallor are considered signs of hypovolemic shock. With impending shock the systolic pressure is less likely to be low than the pulse pressure, particularly in the young and fit person. The pulse rate is not always a reliable sign as tachycardia can also be caused by poor ventilation or anesthetics, and as hemorrhage may be accompanied occasionally by bradycardia, particularly in the aged.

The generally healthy woman undergoing gynecologic surgery does not require transfusion, if the blood loss is less than 500 to 800 ml. The risk from blood transfusion (hepatitis, hemolytic transfusion reaction, septicemia) must be weighed against the possibility of retarding recovery if transfusion is withheld. The patient in poor physical status and the aged should have blood loss replaced accurately.

During exsanguinating hemorrhage with massive blood transfusions measurement of blood-loss and estimation of arterial and venous pressure may help to avoid overtransfusion and undertransfusion.

**Overdose With Anesthetics.** Thiopental, halothane or ether is more likely to cause hypotension than cyclopropane or nitrous oxide. If the anesthetist is in doubt as to the cause of hypotension the concentration of the inhaled anesthetic should always be reduced or the injection of the intravenous anesthetic stopped. The blood level of inhalational anesthetics can be reduced rapidly by "flushing" the lungs with oxygen.

Succinylcholine, decamethonium and gallamine, when given in conventional doses, do not cause hypotension. *D*-tubocurarine may produce hypotension in an occasional, sensitive patient, probably because of the histamine-releasing properties of *d*-tubocurarine.

Hypotension with too vigorous a performance of controlled respiration has been observed in the hypovolemic and debilitated patient. However, positive pressure respiration can hardly be blamed as a cause of hypotension, if performed with a low mean airway pressure (i.e., by allowing the airway



TABLE 3. VASOPRESSORS COMMONLY USED IN ANESTHESIA

DRUG	APPROX. INTRAMUSCULAR DOSE	APPROX. INTRAVENOUS DOSE	EFFECT ON PULSE RATE
Methoxamine (Vasoxyl)	10 mg.	5 mg.	Decr.
Ephedrine	30 mg.	15 mg.	Incr.
Methylamphetamine (Methedrine)	10 mg.	5 mg.	Incr.
Methenteramine (Wyamine)	15 mg.	10 mg.	Decr.
Phenylephrine (Neosynephrine)	—	10 mg./500 ml. cont. infusion	Decr.
Nor-epinephrine (Levophed)*	—	4 mg./500 ml. cont. infusion	Decr.

\* Not suitable for routine use with spinal anesthesia, because too potent and too short acting.

pressure to drop to zero during exhalation). Whenever hypotension occurs, the rate of positive pressure respiration should be reduced in order to permit better filling of the heart.

**Reflex Hypotension From Surgical Stimuli.** If hypotension and bradycardia occur during surgical stimulation of the abdominal viscera, and anesthetic overdose and blood loss have been ruled out, a vagus-type reflex (probably via the celiac plexus) is to be suspected. If, in such a case, atropine (0.5 to 1 mg. I.V.) does not raise the blood pressure promptly, a vasopressor should be injected intravenously (Table 3).

Moderate hypotension which is not due to blood loss is harmless in the young and generally healthy patient, and, therefore, does not have to be corrected. However, in the middle-aged and elderly patient, in the diabetic and in the patient with cardiovascular disease, even moderate reductions in arterial pressure should be corrected promptly with the judicious use of vasopressors, if necessary. In such cases even brief periods of hypotension may cause myocardial infarction or ischemic cerebral damage.

### CHOICE OF ANESTHETIC AGENTS AND TECHNICS

Most operations can be performed safely and satisfactorily with any of a great number of anesthetic agents and technics. More important than the choice of a particular anesthetic is the choice of a particular anesthetist. In teaching departments of anesthesia the choice of the anesthetic for a patient in good

physical status often depends on the training needs. Even with patients in poor physical status more than one approach is usually satisfactory. The anesthetist with limited experience, who is giving anesthesia without supervision, should use the technic with which he is most familiar. The experienced anesthetist should consider why one approach should be preferred to another. The following should be considered: (1) the skill and the training of the anesthetist; (2) the technic to be used by the surgeon; (3) the surgeon's desire to have the patient awake or asleep; (4) electrocautery or other explosion hazards; (5) the need for muscular relaxation or controlled respiration; (6) the physical status and the complicating disease of the patient; (7) the previous experience of the patient with anesthetics and her desire to be awake or asleep.

An internist, asked to evaluate the patient preoperatively, should not suggest the anesthetic to be used. The internist rarely has had firsthand experience in the operating room, which is necessary to understand the problems of induction, airway obstruction, artificial ventilation, the needs of the surgeon, and the influence of disease on the conduct of anesthesia. The judgment and the skill of the anesthetist is more important in the safe choice of an anesthetic than theoretical considerations.

There are very few contraindications to most anesthetic agents or technics. Spinal anesthesia should be avoided in patients with pre-existing neurologic disease, in patients with skin infection over the lumbar puncture area, and in patients who refuse spinal anes-

thetia unless a different anesthetic would appear to be more hazardous. High spinal anesthesia should be avoided in impending and frank shock.

**Pulmonary Disease.** Patients with a history of *asthma* and with wheezes prior to surgery should be prepared with bronchodilator drugs. In asthma, which is not amenable to bronchodilators, treatment with steroids and intermittent positive pressure breathing preoperatively and postoperatively may prove to be lifesaving. Asthmatic patients in need of vaginal operations can be managed safely with spinal or caudal anesthesia. For abdominal procedures the high spinal anesthesia which would be required enhances the likelihood of an asthmatic attack, because of respiratory depression and block of the pulmonary sympathetics. Therefore, general anesthesia is preferred for laparotomies in asthmatics. Although ether anesthesia, because of its bronchodilator effect, has been recommended in the past as the agent of choice for asthmatics, nitrous oxide, halothane, and succinylcholine are likewise safe. However, thiopental and cyclopropane may produce or augment bronchoconstriction. The use of narcotics and long-acting muscle relaxants should be avoided. Excessive bronchial secretions require tracheal intubation for tracheobronchial suctioning.

**Pulmonary tuberculosis** does not contraindicate any anesthetic technic unless the sputum is positive. In such patients any general anesthetic may provoke the spread of a tuberculous process. Therefore, elective surgery should be postponed until the patient is sputum-negative.

For emergency surgery in patients with positive sputum, spinal anesthesia is used whenever possible. Excessive bronchial secretions cause coughing, which may annoy the surgeon; suctioning of the trachea is difficult when the patient is awake under spinal anesthesia but is facilitated with general endotracheal anesthesia.

**Cardiovascular Disease.** Patients with cardiovascular disease should be anesthetized in a way that will not produce sudden changes in their already precarious circulatory balance. Induction must be slow and cautious. Therefore, the surgeon should not be impatient with the anesthetist who performs a

gradual induction with inhalation anesthesia, rather than a rapid induction with thiopental, which may be more hazardous.

Patients with congestive heart disease may benefit from the peripheral vasodilation produced by spinal anesthesia (bloodless phlebectomy). In contrast, patients with coronary artery disease may suffer myocardial infarction if a sudden reduction in aortic pressure occurs. Therefore, in the latter group light general anesthesia is preferred.

**Obesity.** One of the most serious complications in the management of anesthesia is severe obesity, particularly in abdominal surgery in the Trendelenburg position. A short neck often makes tracheal intubation mandatory. When the already overtaxed ventilation of the obese patient is further impaired by the use of narcotics, anesthetics, or relaxants, adequate ventilation can be maintained only with assisted or controlled respiration.

As peripheral arteries and veins are not easily accessible in obese patients, a well-functioning intravenous infusion should be started prior to the induction of anesthesia. Monitoring with the esophageal stethoscope is recommended during prolonged major surgery. Since after major laparotomies postoperative gastric distention and vomiting seem to be more common in obese than in lean patients, a gastric tube is often used prophylactically during the early postoperative period.

Light anesthesia with an inhalational anesthetic, with small amounts of succinylcholine added as needed, is a satisfactory technic in the severely obese patient. The anesthetic must permit rapid recovery of both consciousness and muscle power following surgery. The special attention necessary to ensure adequate ventilation must be extended into the postoperative period.

**Anemia, Low Blood Volume, Shock.** In anemia the oxygen-carrying capacity of the blood is reduced, which narrows the margin of safety in case of airway obstruction or apnea. Therefore, particular attention must be paid to adequate ventilation and high inhaled oxygen concentrations. Patients with anemia, low blood volume or shock require smaller amounts of anesthetics.

In a patient with hypovolemic shock (cold and clammy skin, tachycardia, pallor), cyclo-

levels. This "diffusion hypoxia" may occur not only at the conclusion of the nitrous oxide anesthetic but also during anesthesia when the apparatus is disconnected for insertion of an airway or suctioning of the trachea. Diffusion hypoxia is prevented by "flushing" the lungs with oxygen before letting the patient breathe air.

Sometimes during closure of the skin the patient may appear to breathe adequately, while respiratory depression may supervene as soon as the surgical stimulus has ceased. A partially curarized patient may appear to breathe adequately through the tracheal tube, while she may be unable to overcome increased airway resistance after removal of the tube.

All these hypoxic episodes can be avoided by breath-to-breath control of ventilation until the patient has regained consciousness and full muscle power (Fig. 35). Whenever there is doubt about the adequacy of ventilation, particularly after the use of muscle relaxants, the anesthetist should measure the tidal exchange<sup>11</sup> before moving the patient to the recovery room. Ventilation should be assisted, also during transportation, until tidal volumes of over 300 to 500 ml. have returned.

**Postanesthetic Hypotension.** When during surgery the blood pressure has been supported by surgical reflex stimuli and accumulation of carbon dioxide, hypotension may ensue when both these factors are removed at the conclusion of the anesthesia. This postanesthetic hypotension occurs mainly after deep anesthesia and after periods of inadequate ventilation and is usually associated with a slow pulse rate.

Movement of a patient may cause postural hypotension, particularly when his vasomotor control is blocked by spinal anesthesia, deep general anesthesia or narcotics.

When the patient's legs are lowered after a long operation in the lithotomy position, gravity pooling of blood into the legs may be expected. To prevent this the patient should be placed in the Trendelenburg position and her legs lowered slowly. Possibly also wrapping the legs with elastic bandages may be helpful before lowering the legs.

If operative or postoperative blood loss has been ruled out, the treatment of postanesthetic hypotension consists of placing the

patient in the Trendelenburg position, assuring adequate ventilation and oxygenation and giving intravenous solutions at a more rapid rate. If hypotension persists, a vasoconstrictor drug should be injected intravenously (Table 3).

**Hemorrhage or inadequate replacement of surgical blood loss** must always be suspected when postoperative hypotension is observed. With low blood volume, the skin is cold and clammy, the veins and the arteries are contracted, the pulse-pressure is narrow, and tachycardia is usually present, but not always. Particularly in the aged, bradycardia has been observed during blood loss. In retroperitoneal hemorrhage persistence of hypotension has been seen even after blood has been given much in excess of the amount found in the retroperitoneal space. This can possibly be explained by paravertebral sympathetic blockade caused by the hematoma.

If operative blood loss has been replaced and the signs of shock persist without evidence of external hemorrhage, internal bleeding should be ruled out by physical examination, aspiration of the cul-de-sac or re-exploration of the abdomen. Normal hemoglobin or hematocrit values obviously are meaningless, since hemorrhage leads to hemodilution only slowly.

Inadequate replacement of surgical blood loss may not be detected by hypotension during anesthesia, because of the hypertensive effects of carbon dioxide accumulation, surgical stimuli, or cyclopropane, but hypotension may appear when the stimuli are removed. A generally healthy patient who has lost less than 500 to 800 ml. of blood during surgery does not require transfusion. On the other hand, a woman who has been anemic or hypovolemic before surgery may require more blood than she has lost during surgery, particularly if she is elderly or has cardiovascular disease. A patient in poor physical status preoperatively should have blood loss replaced more accurately. In contrast, patients who have had anemia due to chronic loss of small amounts of blood (metromenorrhagia) may have a normal circulating blood volume due to compensatory elevation of their plasma volume and, therefore, should be transfused with caution to avoid pulmonary edema.

**Uncontrollable oozing** is sometimes ob-

propane is the anesthetic of choice, as, in contrast with other anesthetics, it increases peripheral vascular resistance and cardiac output in light planes of anesthesia and thus counteracts the deterioration of the peripheral circulation in shock. Succinylcholine may be used, although positive pressure respiration should be performed gently and at a slow rate in order to permit filling of the heart. High spinal and epidural anesthesia is contraindicated in patients in shock.

**Pregnancy.** If surgery is required during pregnancy, hypotension, hypoxia and hypercapnea should be avoided at all times. Induction and emergence of anesthesia should be smooth. The use of spinal anesthesia during pregnancy is a controversial matter. Some believe that a spinal block may provoke uterine contractions; others prefer spinal anesthesia because there is less likelihood of hypoxia's occurring. There is no evidence that general anesthetics and narcotics per se may damage the fetus or may cause abortion.

Large amounts of narcotics should be avoided preoperatively and postoperatively in order to prevent hypoxia and hypotension.

When spinal anesthesia is given in full-term pregnancy, two thirds of the regular dose should not be exceeded (Table 2).

**Old Age.** There is no evidence that one anesthetic agent or technic is preferable to another in the elderly patient. Naturally, the aged cannot tolerate as much physiologic trespass as the young adult. Even brief periods of hypoxia or hypotension may result in further deterioration of a senile mind or in the worsening of an existing complicating disease. Preoperative correction of low blood volume and anemia, accurate replacement of blood loss, optimal pulmonary ventilation, and maintenance of a normal blood pressure are all of greater importance in the aged than in the young.

Deep anesthesia should be avoided if possible. Rapidly reversible anesthesia with inhalational drugs is preferred. In the case of hypotension and tachycardia, with anesthetic overdose and blood loss having been ruled out, rapid intravenous digitalization may be helpful.

### THE POSTANESTHETIC PERIOD

The dangers of the immediate postoperative period cannot be overemphasized. Many

deaths have occurred at the conclusion of an operation when the surgeon is leaving the operating room, the anesthetist is transporting the patient, and the nurses are cleaning equipment.

**Recovery Room.** The value of a recovery room is well known. The data of the Baltimore Joint Anesthesia Study Committee indicate that the incidence of postoperative deaths is higher when patients are returned to the ward immediately after surgery.<sup>15</sup>

Most hospitals have acquired a postanesthetic recovery room, in which patients remain until they have recovered from anesthesia. It is desirable to expand such a room to a postsurgical recovery room, which is staffed for 24 hours and thus provides care for surgical patients for as long as they need special attention. One step further has been the establishment of an Intensive Care Unit to which nonoperative as well as operative patients of all departments are admitted. Specially trained nurses should be assigned permanently to these units.

The most common life-threatening complications of the early postoperative period are: (1) asphyxia; (2) postanesthetic hypotension and (3) hemorrhage or inadequate replacement of surgical blood loss.

**Asphyxia.** Laryngospasm, breath-holding, vomiting and upper airway soft-tissue obstruction by the sagging tongue may occur, particularly following removal of the tracheal tube. Therefore, extubation should be performed either under deep anesthesia or, preferably, when the patient has regained consciousness. Suctioning and resuscitative equipment must be on hand for removal of the tube.

Hypoxia may occur when respirations are depressed or the mask or the tracheal tube is removed and the high inhaled oxygen concentration used during anesthesia is suddenly reduced to that of air.

Hypoxia may also occur when the anesthetic apparatus is disconnected from the patient at the conclusion of a nitrous oxide anesthetic, without previous hyperoxygenation of the lungs. In this case, nitrous oxide, which is much more soluble in the blood than nitrogen, leaves the blood in large quantities and floods the alveoli, which, in combination with the inhaled nitrogen of the air, may dilute the alveolar oxygen to dangerously low

levels. This "diffusion hypoxia" may occur not only at the conclusion of the nitrous oxide anesthetic but also during anesthesia when the apparatus is disconnected for insertion of an airway or suctioning of the trachea. Diffusion hypoxia is prevented by "flushing" the lungs with oxygen before letting the patient breathe air.

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patient in the Trendelenburg position, assuring adequate ventilation and oxygenation and giving intravenous solutions at a more rapid rate. If hypotension persists, a vasopressor drug should be injected intravenously (Table 3).

**Hemorrhage or inadequate replacement of surgical blood loss** must always be suspected when postoperative hypotension is observed. With low blood volume, the skin is cold and clammy, the veins and the arteries are contracted, the pulse-pressure is narrow, and tachycardia is usually present, but not always. Particularly in the aged, bradycardia has been observed during blood loss. In retroperitoneal hemorrhage persistence of hypotension has been seen even after blood has been given much in excess of the amount found in the retroperitoneal space. This can possibly be explained by paravertebral sympathetic blockade caused by the hematoma.

If operative blood loss has been replaced and the signs of shock persist without evidence of external hemorrhage, internal bleeding should be ruled out by physical examination, aspiration of the cul-de-sac or re-exploration of the abdomen. Normal hemoglobin or hematocrit values obviously are meaningless, since hemorrhage leads to hemodilution only slowly.

Inadequate replacement of surgical blood loss may not be detected by hypotension during anesthesia, because of the hypertensive effects of carbon dioxide accumulation, surgical stimuli, or cyclopropane, but hypotension may appear when the stimuli are removed. A generally healthy patient who has lost less than 500 to 800 ml. of blood during surgery does not require transfusion. On the other hand, a woman who has been anemic or hypovolemic before surgery may require more blood than she has lost during surgery, particularly if she is elderly or has cardiovascular disease. A patient in poor physical status preoperatively should have blood loss replaced more accurately. In contrast, patients who have had anemia due to chronic loss of small amounts of blood (metromenorrhagia) may have a normal circulating blood volume due to compensatory elevation of their plasma volume and, therefore, should be transfused with caution to avoid pulmonary edema.

**Uncontrollable nausea** is sometimes ob-

served after extensive pelvic surgery. The etiology of this oozing is obscure, although it is known that some organs, such as the uterus, may liberate substances which block coagulation. Also banked blood, when transfused in large quantities, may be responsible for oozing, since it lacks clotting factors. Unusual oozing and unexpected hypotension during anesthesia may be the signs of a hemolytic transfusion reaction. This is best ruled out by inspection of a centrifuged blood sample. The best treatment for uncontrollable oozing is the infusion of fresh whole blood, i.e., blood drawn within 1 to 2 hours. Also, calcium gluconate (10%, 0.5 to 1 Gm. intravenously) and, in the case of a positive fibrinolysin test, intravenous fibrinogen, may be helpful.

**Emergence Delirium.** Occasionally, excitement may occur at the conclusion of an anesthetic. This may be so severe that the personnel may have difficulty in preventing the patient from injuring herself. Emergence delirium may be due to hypoxia, hypotension, pain, or to unknown factors associated with the elimination of the anesthetic. Delirium appears to occur more often after the use of cyclopropane or scopolamine, after inadequate pulmonary ventilation, and when no narcotics were used for premedication. If hypoxia and hypotension are ruled out, emergence delirium is easily remedied by the intravenous injection of morphine (3 to 5 mg.) or meperidine (25 mg.), which may be repeated.

**Acute Postoperative Pain.** For pain in the immediate postoperative period in the operating room or the recovery room, we prefer to titrate analgesia with intravenous injections of small amounts of narcotics (morphine, 3 to 5 mg.; meperidine, 12.5 to 25 mg.).

**Oxygen Therapy.** Following gynecologic operations, oxygen therapy is rarely required, unless the patient has a complicating disease. Respiratory insufficiency may occur after major abdominal surgery in patients with severe pulmonary disease. Incisional pain and abdominal distention augment the respiratory insufficiency, which may necessitate mechanical assistance of breathing with a respirator. Tracheotomy, mechanical ventilation and oxygen therapy in the patient with

severe pulmonary disease should not be used as a last resort but started as soon as there seems to be the slightest difficulty in breathing. These techniques are specialized and require the help of an expert consultant.

The equipment used for oxygen therapy in the immediate postoperative period includes the plastic face tent, the plastic oronasal face mask and the nasal catheter. The flow rates used with the face tent and mask should be at least 10 liters per minute in order to prevent carbon dioxide accumulation; the flow rates used with the nasal catheter should be 4 to 6 liters per minute. Oxygen tents hamper nursing care and usually provide lower concentrations of oxygen than the inexpensive equipment mentioned above. Harm, i.e., pulmonary irritation, may occur only if oxygen concentrations of over 70 per cent are inhaled for more than 12 hours. The nasal catheter and the face tent usually provide inhaled oxygen concentrations of approximately 50 per cent, while the face mask may provide concentrations as high as 90 per cent.

Dry oxygen rapidly causes drying of the respiratory mucosa, which destroys ciliary activity, and thus may lead to atelectasis and pneumonitis. Humidification of the inhaled atmosphere is particularly important in patients with tracheotomies.

Before ordering oxygen therapy the physician should be familiar with its basic concepts and with the equipment available.

In acute pulmonary edema intermittent positive pressure breathing with bag-mask-oxygen or with a mechanical respirator is the single most important therapeutic maneuver. Simultaneously, reduction of venous return by the sitting position, phlebotomy and morphine and the use of digitalis and bronchodilators may be employed as indicated.

**Carbon Dioxide Therapy.** The inhalation of high concentrations of carbon dioxide for stimulating respiration in the patient after abdominal surgery in an attempt to prevent postoperative atelectasis should be used only if the patient is awake. A simple method which does not depend upon the use of carbon dioxide cylinders but rather on the accumulation of endogenous carbon dioxide is recommended: the patient re-breathes

through an artificial dead space consisting of a breathing tube 57 inches long, 1 inch in diameter and 650 cc. capacity. Oxygen (4 L./min.) is directed into the tail end to prevent hypoxia. Breathing through this tube for 5 minutes usually doubles the tidal volumes. This treatment is used routinely about every 2 hours during the early postoperative period after abdominal surgery.

Other methods used for preventing atelectasis include: (1) deep breathing and coughing; (2) frequent change of position to prevent hypostasis; (3) early ambulation; (4) exhaling against a resistance of 10 to 20 cm. of water (blow bottle).

### MONITORING OF VITAL SIGNS

The early recognition and treatment of respiratory and circulatory disaster requires the continuous monitoring of vital signs during anesthesia and surgery. Stoppage of pulmonary ventilation due to complete airway obstruction or apnea leads to irreversible central nervous system damage and to cardiac arrest within a few minutes. Even partial airway obstruction when prolonged may lead to irreversible hypoxic brain damage. The cessation of circulation due to causes other than anoxia (e.g., from anesthetic overdose) causes irreversible brain damage within 3 to 4 minutes. Prolonged hypotension may lead to postoperative renal damage or myocardial infarction.

The most reliable, simplest and least expensive monitors are the anesthetist's senses.

**Monitoring of Ventilation.** It is common practice to observe and record the respiratory rate of the spontaneously breathing patient during anesthesia. However, more important than the rate is the tidal volume of respiration. Experienced anesthetists can judge the depth of each breath by observing the anesthetic breathing bag and the movements of the patient's chest. Hypoventilation has been shown to be harmful, while hyperventilation under anesthesia has proved to be safe. Therefore, most anesthetists deliberately hyperventilate their patients in order to provide an adequate margin of safety and thus find little need for the accurate measurement of tidal exchange. However, ventilation meters, which can be inserted into the anesthetic system<sup>11</sup> are useful for measuring

tidal volumes when the respiratory movements are still depressed, particularly after the use of muscle-relaxant drugs.

Artificial positive pressure respiration (controlled respiration), a common practice in modern anesthesia, abolishes the most useful sign of life, namely, spontaneous breathing movements. Under such circumstances even greater attention should be paid to the color of the mucous membranes, the pulse, the blood pressure and the heart sounds.

**Monitoring of Circulation.** There is no substitute for continuous palpation of the peripheral pulse. Any accessible artery may be used.

Intermittent checking of the blood pressure with the Riva-Rocci cuff method is desirable, but it should neither replace continuous palpation of the pulse nor cause interruption of artificial respiration in the apneic patient for more than a few seconds. Usually, the blood pressure becomes unobtainable before the pulse disappears. Therefore, when no pulse is palpable in a large artery, valuable seconds should not be wasted in searching for the blood pressure, but artificial ventilation and closed chest cardiac massage should be started immediately.

**Heart sounds** may be monitored either with a regular stethoscope taped over the precordium or with an esophageal stethoscope. The esophageal stethoscope, which consists of a thin rubber tube with a cufflike diaphragm at one end, is inserted through the patient's nose or mouth to the level of the midesophagus. The esophageal stethoscope should never be inserted under light anesthesia, unless a tracheal tube is in place, because of the danger of provoking laryngospasm. The outer end of the tube is connected to an ear-piece via a long connecting tube which permits mobility of the anesthetist. Whenever heart sounds are continuously monitored, continuous palpation of the pulse is not necessary, and the hands of the anesthetist are free for other tasks. Continuous monitoring of heart sounds not only gives information concerning the heart rate but also concerning the quality of cardiac contractions. During shock, when the heart sounds become faint, such information may be important.

Usually, inadequate oxygenation or circu-

lation causes *cyanosis* of the mucous membranes, the skin and the blood in the surgical incision. Cyanosis depends upon the total amount of reduced hemoglobin in the arterial blood. Therefore, hypoxia in an anemic person may not produce cyanosis, while a polycythemic person may be cyanotic in spite of adequate oxygenation. When the surgeon remarks that the blood is dark, the anesthetist should rule out hypoxemia by checking ventilation and the color at other sites. The dark blood may come from venous blood, particularly during the use of anesthetic technics causing venous pooling.

The anesthetist should observe repeatedly the color of the patient's tongue, lips, nail beds and ear lobes. The *tongue* is the most reliable site for ascertaining the pink or cyanotic color of the arterial blood. This is particularly true in Negroes in whom hypoxia may easily go unnoticed because of difficulty in recognizing cyanosis at other sites. In order to maintain a smooth anesthesia, the anesthetist should also observe the eye signs, the breathing pattern and muscle tone.

During anesthesia and surgery harmful respiratory and circulatory changes may occur suddenly. The most tragic anesthetic deaths have occurred in generally healthy patients undergoing minor surgery. Therefore, a reliable, inexpensive and simple monitoring device should be used routinely in all patients for all types of surgery. *Palpating* the pulse, *watching* the color and the respiratory excursions, and *listening* to the heart sounds fulfill these criteria better than expensive electronic equipment.

### RESUSCITATION

Every physician and nurse should be capable of promptly recognizing and treating airway obstruction, apnea and cardiac arrest. The correct management of these life-threatening conditions requires rapid and effective action. There is no time to diagnose the cause of the complication or to call for help. If resuscitation is to be effective, some previous training is necessary.

Since resuscitation cannot be learned by reading alone we urge physicians and medical students to seek the opportunity of practicing



FIG. 35. Lateral position for unconscious patient not requiring resuscitation. Head-tilt for airway patency. Air exchange felt at mouth and nose. Bag-mask unit, artificial airway and suction immediately available.



resuscitation technics on anesthetized, apneic subjects with the supervision of an anesthetist.

The following paragraphs are designed to help the reader to establish in his mind a step-by-step plan of action.

**Airway Obstruction.** Airway obstruction and/or apnea is an ever-present threat in the management of any unconscious patient. Complete airway obstruction, if not treated promptly, leads to asphyxia (i.e., hypoxia plus hypercapnea), which in turn causes irreversible cerebral damage within a few minutes and finally apnea and cardiac arrest.

In the patient with *spontaneous breathing movements* the diagnosis of *complete* airway obstruction is made when no air movement can be *felt* or *heard* at the mouth or the nose; in the *apneic* patient complete airway obstruction is diagnosed when attempts at *inflating the lungs with positive pressure* respiration have failed.

The diagnosis of *partial* airway obstruction is made when the patient is breathing noisily or when spontaneous inspirations

cause retraction of the suprasternal area and the intercostal spaces. A snoring sound usually indicates upper airway soft-tissue obstruction by the tongue, due to flexion of the neck; a crowing sound usually indicates adduction of the vocal cords; and a gurgling sound indicates obstruction by foreign matter, such as saliva or gastric content. Even partial airway obstruction should be corrected rapidly, since it may lead to pulmonary edema, cerebral edema, exhaustion, apnea and cardiac arrest.

Most physicians are familiar with airway obstruction at the level of the lips, the nose, or the larynx and with obstruction by foreign matter such as vomitus. In the unconscious patient, however, the most common type of airway obstruction is often overlooked, namely, obstruction of the hypopharynx by the relaxed tongue, which is pushed against the posterior pharyngeal wall when the neck is flexed and the mandible is sagging (Fig. 36 B).<sup>18</sup> If the unconscious patient is lying on a flat surface, the unsupported head usually assumes a flexed position, producing



A



B



C

FIG. 36. Roentgenograms of hypopharyngeal air passage. (A) Hypopharynx of conscious, supine adult with the head in the mid-position. (B) Same patient and same head position; anesthetized and curarized; note complete obstruction of the hypopharynx by the sagging tongue. (C) Same patient, anesthetized and curarized; head tilted backward maximally; note wide open hypopharynx.

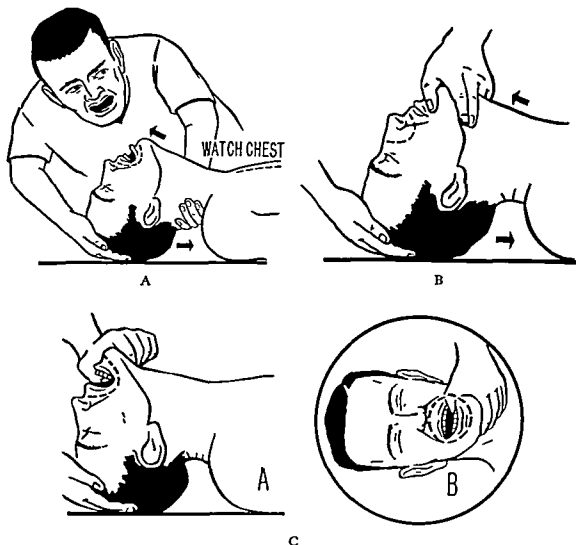


FIG. 37. Direct exhaled air resuscitation. Hold the patient's head tilted backward maximally throughout, with your right hand remaining at his forehead.

(A) *Mouth-to-Mouth*: Take a deep breath, open your mouth widely, place your mouth over his mouth and blow forcefully; encircle the patient's entire mouth to get a tight seal. While you are blowing press your cheek against the patient's nostrils to prevent air leakage. (In infants blow gently into mouth and nose.) When the chest moves, take your mouth off and permit passive exhalation. Repeat inflations every 3 to 5 seconds. Rhythm is not important. If the chest does not move, proceed to (B).

(B) *Mouth-to-Nose*: Maintain the head tilted backward. Close the patient's mouth by pulling the chin up with your left hand and blow into the nose. If you notice expiratory obstruction open the mouth to provide for exhalation. If this also fails to ventilate the lungs, proceed to (C).

(C) *Mouth-to-Mouth-Jaw Lift*: Maintain the head tilted backward with your right hand at the forehead. Insert the thumb of your left hand into the left corner of the patient's mouth, grasp the chin and pull the mandible forcefully upward. Place your mouth over the patient's mouth, including your thumb, to make an air-tight contact, and blow. Your cheek seals the patient's nostrils.

(Safar, P., and McMahon, M. C.: *Resuscitation of the Unconscious Victim*, ed. 2, Springfield, Ill., Thomas)

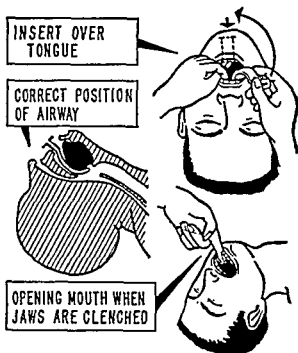


FIG. 38. Insertion of oropharyngeal airway. Pry the teeth apart with one hand, thumb and index finger crossed. With the other hand insert the airway over the tongue, first with the curved part backward, and turn it into the proper position while inserting it deeper. This twisting maneuver prevents pushing the tongue back. (Safar, P., and McMahon, M. D.: *Resuscitation of the Unconscious Victim*, ed. 2, Springfield, Ill., Thomas)

partial or complete obstruction. Maximal backward tilt of the head alone can prevent this type of pharyngeal obstruction in most instances (Fig. 36 C). Postoperative cardiac arrest seems to be due surprisingly often to unrecognized upper airway soft-tissue obstruction. For instance, heavy postoperative sedation may produce narcosis, leading to flexion of the neck and obstruction. Therefore, the occiput of an unconscious patient should never be elevated by a pillow, but rather the head should be tilted backward at all times. Elevating the shoulders facilitates the head-tilt. If the unconscious patient does not need resuscitation, she should be placed on her side with the head tilted backward to facilitate drainage of saliva from the corner of the mouth (Fig. 35). Pharyngeal obstruction by the tongue is equally common in the prone position when the neck is flexed.<sup>18</sup>

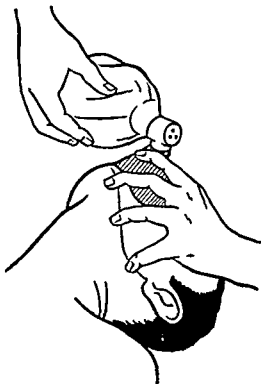


FIG. 39. Positive pressure ventilation with bag-mask (self-inflating bag with nonrebreathing valve designed by Ruben): Tilt the head back maximally. Hold the mask firmly over the patient's face with one hand. Inflate the lungs by squeezing the bag with the other hand. When the chest moves, release the pressure abruptly to permit passive exhalation (maintaining pressure during exhalation makes the valve stick). If the chest does not rise, remove foreign matter from the mouth and the pharynx and insert an oropharyngeal airway if indicated. Oxygen may be added at the intake valve. (Safar, P., and McMahon, M. D.: *Resuscitation of the Unconscious Victim*, ed. 2, Springfield, Ill., Thomas)

Airway obstruction may also occur when the mouth is closed in the presence of nasal obstruction. Although backward tilt of the head is the single most important step in relieving soft-tissue upper airway obstruction, occasional patients require in addition forward displacement of the mandible (Fig. 37 C) or insertion of an artificial oropharyngeal airway (Fig. 38) or both.

The use of artificial oropharyngeal airways makes maintenance of a patent airway easier, since the airway holds the base

of the tongue forward and prevents obstruction by the lips and the teeth (Fig. 38). An airway should be inserted only if there is evidence of obstruction in spite of the head-tilt and if the patient is limp and unconscious. In the semiconscious person the airway may produce laryngospasm or gagging. Insertion of a nasopharyngeal tube may be useful when the jaws are clenched, although it may produce epistaxis.

Frequently, when airway obstruction appears to be complete during spontaneous respiratory efforts, the obstruction may be overcome by forceful positive pressure inflations. Therefore, tracheal intubation or tracheotomy never should be the first step in resuscitation. In a patient in respiratory distress, cardiac arrest has been observed during prolonged unsuccessful attempts at tracheal intubation or tracheotomy. In an emergency, tracheotomy or tracheal intubation always should be preceded by attempts at inflating the lungs mouth-to-mouth (Fig. 37) or with bag-mask (Fig. 39).

Physicians not trained in anesthesiology or otolaryngology can rarely perform oro-tracheal intubation successfully within seconds. Likewise, tracheotomy often becomes a prolonged procedure, complicated by bleeding and exaggerated movements of the neck structures in a struggling, asphyxiating patient. Therefore, in the hands of most physicians, incision of the cricothyroid membrane may be a more rapid and effective approach.<sup>13</sup>

**Apnea.** The key to successful artificial respiration is a patent upper airway. Therefore, backward tilt of the head and—if necessary—the other maneuvers outlined in the previous paragraph must precede and accompany artificial respiration.

Intermittent positive pressure ventilation of the lungs is the only reliable way of performing emergency artificial respiration. Methods of artificial respiration which depend upon compression and expansion of the chest usually fail to move adequate amounts of air.<sup>19, 20, 22</sup> Intermittent positive pressure ventilation permits the operator to support the upper airway and to determine the efficacy of each inflation effort.

The operator must be able to change at will the pressure and the rate of inflation according to the variable airway resistance,

lung-thorax compliance and air leakage. This is possible with exhaled air resuscitation (Fig. 37) and the use of hand-operated equipment such as bags (Fig. 39) or bellows, but not with the use of automatic resuscitators with fixed inflation pressures.

Intermittent positive pressure ventilation may be performed with exhaled air, atmospheric air, or oxygen. The patient's lungs are inflated with positive pressure applied to the upper airways, while deflation is passive. During the performance of any method of intermittent positive pressure ventilation the operator must (1) provide an adequate airway, (2) prevent air leaks and (3) provide adequate inflation pressures.

In an attempt to reoxygenate an asphyxiated person time is more valuable than high concentrations of oxygen. Therefore, mouth-to-mouth or mouth-to-nose breathing (Fig. 37) should be started without delay if equipment is not immediately available. The oral or nasal air passage should be selected, depending on which one proves to be more patent. The oral air passage is more reliable; with the use of the nasal air passage expiratory obstruction is common, but it is easier to produce a tight seal with the lips. Either technic can be made more acceptable by placing a handkerchief over the patient's face. Adjuncts for exhaled air resuscitation, such as S-shaped oropharyngeal airways or masks, should be used only if immediately available and if the operator is trained in their use.<sup>20</sup>

Lung inflations with exhaled air at a rate of at least 12 per minute and with tidal volumes of at least 1,000 ml. can maintain normal oxygen and carbon dioxide values in apneic adults whose lungs are healthy. Hyperventilation compensates for the low oxygen and high carbon dioxide tension of exhaled air.<sup>22</sup>

Positive pressure ventilation with atmospheric air may be performed with a self-inflating *Ruben* bag (Fig. 39),<sup>20</sup> which does not depend on a supply of oxygen. The valve fits both standard anesthesia masks and tracheal tube adaptors. Oxygen may be added if necessary, for instance in patients with pulmonary disease.

Positive pressure ventilation with oxygen is best performed with the oxygen bag-mask unit of the anesthetist.<sup>20</sup> This unit not only enables the operator to provide oxygen in-

halation for the spontaneously breathing patient, to assist shallow respirations and to produce positive pressure artificial respiration, but also to sustain positive pressure during both inspiration and expiration. The latter is desirable in the treatment of acute pulmonary edema. The high flow of oxygen required for the removal of carbon dioxide makes it necessary to provide a leak, optimally at the mask, whenever the bag over-distends. This balancing of bag-distention against mask-leakage may prove to be difficult in the hands of the person not trained in anesthesia.

The operator, when performing positive pressure respiration, should always watch the patient's chest and correct his performance as required.

**Cardiac Arrest.** Cessation of circulation from either asystole or ventricular fibrillation which occurs unexpectedly is termed cardiac arrest.

Whenever artificial respiration plus thoracotomy and open-chest cardiac massage has been performed swiftly and efficiently, survival has often occurred, as indicated by reported over-all survival rates of 17 to 52 per cent.<sup>7,21</sup> Resuscitation outside the operating room has been successful less frequently. The future will show whether or not the new and simpler method of closed chest cardiac massage<sup>5</sup> will yield higher survival rates.

But more important than the *treatment* of cardiac arrest is its *prevention*. Cardiac arrest in patients undergoing elective surgery is rarely a sudden event; the deterioration of circulation and poor oxygenation leading to cardiac arrest often is simply not recognized until the patient has become pulseless and apneic. In most cardiac arrests one or more of the following factors is involved: (1) oxygen lack and/or carbon dioxide excess due to airway obstruction or respiratory depression; (2) circulatory depression by anesthetic overdose; (3) hemorrhage; (4) coronary occlusion. Therefore, the prevention of cardiac arrest lies in the most meticulous monitoring of vital signs so that respiratory and circulatory distress will be recognized early and corrected.

**DIAGNOSIS OF CARDIAC ARREST.** Effective treatment of cardiac arrest depends on immediate diagnosis. The clinical signs of car-

diac arrest, in order of reliability, are as follows: (1) absence of pulse in large arteries; (2) respiratory arrest in a previously spontaneously breathing person; (3) ashen-gray or waxen color of the mucous membranes; (4) dilated, nonreactive pupils and dry conjunctiva; (5) absence of bleeding in the wound; (6) absence of heart sounds on auscultation. Searching for heart sounds is unreliable and never should delay resuscitation.

**CLOSED-CHEST CARDIAC MASSAGE.** Recently, Kouwenhoven, Jude and Knickerbocker<sup>8</sup> have shown in proved cases of cardiac arrest that near-normal systolic blood pressures can be produced in man by the rhythmic compression of the heart between the sternum and the vertebral column. The great advantage of closed-chest cardiac massage over the open method lies in the fact that the closed technic (1) can be started more rapidly, and (2) can be applied with less likelihood of injuring the heart and without the risk of post-thoracotomy complications; and (3) it can be applied by non-medical personnel.

However, sternal compression cannot be relied upon to ventilate the lungs, even when the upper airway is patent.<sup>16</sup> Therefore, closed-chest cardiac massage *must* be preceded by and accompanied by positive pressure ventilation of the lungs. Artificial circulation without oxygenation is useless; pulseless, apneic patients have occasionally recovered with ventilation of the lungs alone.

**TECHNIC OF VENTILATION PLUS CLOSED-CHEST CARDIAC MASSAGE** (Fig. 40). For optimal performance 3 operators are needed: one to ventilate the lungs, one to perform sternal compressions, and one to monitor the pulse. The first operator ventilates the lungs with intermittent positive pressure respiration. If a pulse is not palpable in a large artery after a few effective lung inflations, the second operator kneels next to the patient's chest and presses the sternum vigorously against the vertebral column, at intervals of 1 second. The technic consists of (1) placing the heel of one hand over the lower half of the sternum in the mid-line and the heel of the other hand on top of the first hand; (2) pressing the sternum firmly downward toward the back until firm resistance is felt; and (3) raising both hands to permit



FIGURE 40. (Caption on facing page)

chest expansion. The third operator monitors the pulse.

There are many ways of combining ventilation and sternal compression. One practical way is to perform 4 sternal compressions after each lung inflation at intervals of 1 second, producing approximately 48 heart compressions and 12 lung inflations per minute. To prevent the first and the second operators from interfering with each other, the massaging operator must cease sternal compressions to permit the ventilating operator to inflate the lungs and to see the chest move in order to detect airway obstruction. Although rhythm is not important in artificial respiration, in this technic it is important, as it prevents the maneuver of the massaging operator from interfering with the maneuver of the ventilating operator. Such timing of lung inflations is best accomplished with exhaled air resuscitation and hand-operated equipment.

An alternate approach, particularly recommended for a single operator, consists of following each 2 or 3 lung inflations with a period of 15 to 30 seconds of uninterrupted sternal compressions.

Whenever asystole or ventricular fibrillation occurs suddenly in the spontaneously breathing patient (e.g., coronary occlusion), spontaneous gasping may possibly not cease if closed chest cardiac massage is started immediately. In such cases the ventilating operator would need only to provide a patent airway, to administer oxygen or to assist respiration.

Trauma from closed chest cardiac massage has been seen in the form of fractures of the ribs and the costal cartilages. However, autopsy findings indicate that this trauma would not be incompatible with survival, and in the old and emphysematous patient cardiac massage actually seems to become more effective when the thorax becomes more pliable following rib fractures.

**OPEN-CHEST CARDIAC MASSAGE.**<sup>7, 21</sup> With

the introduction of closed-chest cardiac massage, the future role of thoracotomy and direct manual compressions of the heart is unknown. Although blood flow rates in dogs were similar during the performance of both the open and closed technics, no data is yet available to ascertain which method is mechanically more effective in man. Nevertheless, we feel that closed-chest cardiac massage should be performed for about 1 minute; if no artificial pulse can be felt during this trial period, the chest should be opened.

Open-chest cardiac massage is performed through a left anterior thoracotomy beneath the left breast at the level of the 4th intercostal space. The pleura should be entered carefully, the adjacent costal cartilages incised, and manual systole of the heart started immediately without opening the pericardium. In adults, manual systole is best performed with one hand behind the heart and the other hand in front of the heart. If the incision is too small for both hands, the heart can be compressed against the sternum with one hand. Care must be taken not to pierce the auricles with the fingertips. The heart should be compressed about 40 to 60 times per minute, depending on how rapidly the heart fills. If spontaneous contractions do not return promptly, the pericardium should be incised for diagnosing ventricular fibrillation or asystole and for facilitating injection of drugs into the left ventricle.

**DEFIBRILLATION AND CARDIAC STIMULANTS.** During cardiac resuscitation it is important to restore effective spontaneous cardiac contractions as rapidly as possible, as the blood flow produced by manual systole is only a fraction of that produced by spontaneous cardiac contractions. If the femoral or carotid pulse cannot be felt during massage, the rate of sternal compression should be reduced to permit better filling of the heart, and the legs should be elevated to improve venous return to the heart. If the abdomen is open, the aorta should be com-

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FIG. 40. Ventilation plus closed chest cardiac massage. (Top) Ventilation with bag-mask. (Bottom) Ventilation mouth-to-mouth.

Operator (1) holds the patient's head tilted backward and inflates the lungs, while operator (2) pauses. Then, operator (2) performs four sternal compressions at one-second intervals, while operator (1) pauses. This cycle of four sternal compressions following each lung inflation is repeated as long as resuscitation is required. Operator (3) monitors the pulse.

pressed in order to improve blood flow to the brain. Also, the rate of the intravenous infusion should be speeded up and nor-epinephrine added.

While an electrocardiograph and an external defibrillator<sup>25</sup> are being obtained, closed-chest cardiac massage should be interrupted briefly at times to determine whether or not a spontaneous pulse has returned. If the electrocardiogram shows ventricular fibrillation, massage should be interrupted briefly for the application of an external defibrillating shock (450 volts, 0.25 sec.). The electrodes, covered with conductive jelly, are pressed firmly against the skin, one over the suprasternal notch, the other over the apex of the heart. The operator should wear rubber gloves. The electrocardiographic leads should be disconnected during application of the shock in order to avoid damaging the apparatus. If a single shock fails to defibrillate, a series of 3 shocks should be applied at 1-second intervals. If this also fails, the voltage should be increased (maximum increased to 750 volts). If all these maneuvers fail to defibrillate the heart, an intracardiac injection of epinephrine (0.2-0.5 mg.) may improve the tonus of fibrillation and thus the likelihood of successful electrical defibrillation. If an external defibrillator is not available and a spontaneous pulse has not returned during a few minutes of closed chest cardiac massage, the chest should be opened to permit inspection of the heart and direct electrical defibrillation if ventricular fibrillation is found.

If the EKG shows *asystole*, and if closed chest cardiac massage for 2 to 3 minutes does not produce a spontaneous pulse, massage should be interrupted briefly for an intracardiac injection of calcium chloride (10%, 5 ml.) or epinephrine (0.2 to 0.5 mg.), which may be repeated if necessary. Transthoracic intracardiac injection is best performed with a 4-inch 22-gauge needle, either parasternally through the 5th left intercostal space or through the diaphragm at the level of the xyphoid, obliquely cephalad. Between attempts at defibrillation and between intracardiac injections, sternal compressions should be continued in order to reoxygenate the myocardium, as it is easier to defibrillate an oxygenated heart than an anoxic heart.

Although it is desirable to diagnose ventricular fibrillation or asystole prior to treatment, some feel that an external defibrillating shock can do no harm if applied whenever there is asystole or normal cardiac contractions. Therefore, if it is impossible to obtain an electrocardiograph, an external defibrillating shock may be applied empirically if after 2 to 3 minutes of closed chest cardiac massage there is no evidence of a spontaneous pulse. External or internal electrical pacemakers are not useful in emergency resuscitation of a normal heart. Artificial pacemakers cannot cause cardiac contractions in an anoxic heart. Their chief use is in heart block, where excessive slowing of the heart rate (detected by a monitor) automatically triggers the electrical pacemaker. With the occurrence of syncope in a patient with heart block, pounding of the chest precordially may be substituted in the absence of an electrical pacemaker.

**GAS EMBOLISM.**<sup>14</sup> Gas embolism may occur during insufflation of the fallopian tubes, with sectioning of large pelvic veins, following criminal abortions or as a result of blood transfusion under pressure. If large quantities of air reach the right ventricle, the pulmonary artery becomes obstructed, leading to arterial hypotension, venous congestion and right heart failure. Small amounts of air may pass through the pulmonary circulation and come to obstruct cerebral or coronary vessels.

Whenever air embolism is suspected, the patient should be turned promptly into the left lateral position and the head lowered. This tends to prevent foam from obstructing the pulmonary outflow. At the same time intermittent positive pressure ventilation with oxygen should be started. If the patient becomes pulseless and apneic, *right* thoracotomy and direct manual cardiac systole should be started promptly, and an attempt should be made to aspirate the air from the right ventricle.

**TREATMENT FOLLOWING CARDIAC RESUSCITATION.** If the patient is not under the influence of anesthetics or narcotics and remains unconscious following the successful restoration of circulation, the same meticulous care of airway, respirations and circulation must be given as with any unconscious patient. Prophylactic lowering of the body



temperature following a period of cerebral anoxia may enhance recovery without major irreversible cerebral damage.<sup>3</sup> Therefore, if the patient remains unconscious, and there is little return of reflexes within 15 to 30 minutes after cardiac arrest, hypothermia of approximately 30° should be induced and

maintained from 48 to 72 hours. With the use of hypothermia complete recovery has been observed after as long as 10 days of unconsciousness following cardiac arrest. During hypothermia shivering must be prevented with drugs, and ventilation should be provided by a respirator via tracheotomy.

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# Opening and Closing the Abdomen

## OPENING THE ABDOMEN

There are 5 incisions through which practically all pelvic laparotomies can be done: the mid-line, the right or left rectus, the modified Pfannenstiel, the transverse and the muscle-splitting gridiron incision.

### MID-LINE INCISION

The majority of pelvic laparotomies can be performed to greatest advantage through the mid-line incision. The average mid-line incision extends from a little below the umbilicus almost to the symphysis (Fig. 41). In thin individuals, when relatively simple intrapelvic operations are done, not nearly all of this space need be utilized. On the other hand, when large fibroids or ovarian tumors are to be removed, the incision may require lengthening upward. Then it may be deflected to the side of the umbilicus and carried as high as necessary for proper exposure to permit safe removal of the tumor. There is no point in making unnecessarily long incisions; on the other hand, too short an incision will prevent the surgeon from doing his best work. The old surgical saying that all surgery is difficult with poor exposure, and most surgery is easy when exposure is adequate holds true when dealing with pelvic laparotomy.

The incision is made through the skin with a swift, steady stroke for the full length of the incision. The cut is carried down through the fat to the linea alba. Bleeders are clamped with Halsted clamps. It is our custom not to tie these bleeders but to proceed with the operation and remove the clamps during closure of the abdomen. Often no vessels will require clamping. Those that do bleed on removal of the clamps must be reclamped and ligated with No. 000 chromic catgut.

The aponeurosis is incised at the linea alba for the full length of the incision. This

also is done with a clean stroke of the scalpel. In parous women there is usually no difficulty in finding the mid-line for separation of the rectus muscles. In nulliparous women the two rectus muscles may lie so closely in apposition that the mid-line is located with difficulty. The *pyramidalis* muscles at the lower end of the fascial incision are the most useful landmark in directing the surgeon to the mid-line. There is great variation in the development of the *pyramidalis* muscles, but

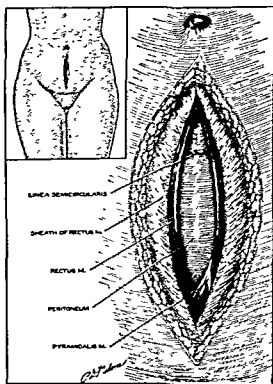
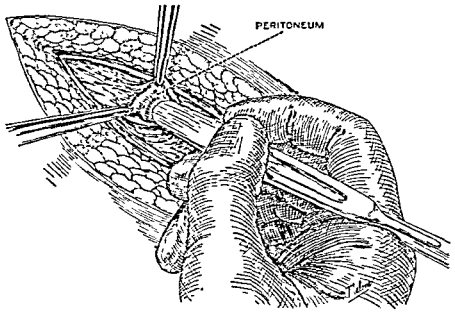


FIG. 41. Usual mid-line incision. Inset indicates position of incision. Skin, fat and rectus sheath have been cut in the mid-line. The peritoneum, in the lower portion, and the posterior rectus sheath in the upper part are visible.

FIG. 42. The peritoneum is held up by two mouse-tooth forceps, and the bowel is pushed back before the peritoneum is incised.



if the incision is carried low enough usually one of these will be visible anterior to the rectus muscles. The outer margin of the pyramidalis is directed inward and upward toward the mid-line (Fig. 41). If the incision is a long one, extending nearly to the umbilicus, often one can see a separation of the rectus muscles as they approach the umbilicus. The rectus muscles usually can be separated readily with the handle of the scalpel. At this point the skin is covered with towels or gauze brought directly to the cut edges, before entering the peritoneal cavity.

The preperitoneal fat is incised, and the peritoneum becomes visible. Often the ura-

chus is seen, indicating the mid-line. The peritoneum is picked up by the operator and the assistant with mouse-tooth forceps and is incised carefully. Great caution must be exercised in incising the peritoneum to avoid incision of the bowel wall. Pushing the bowel away with the knife handle before incising the peritoneum is an excellent precaution (Fig. 42). The cut edges of the peritoneum are grasped with Kelly clamps, and the peritoneal incision is enlarged slightly. The fingers of the operator and the assistant are inserted in the peritoneal cavity, lifting up the abdominal wall as the peritoneum is cut for the full length of the incision (Fig. 43).

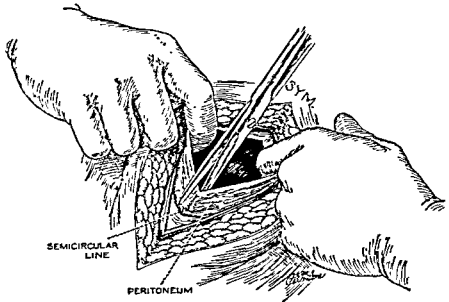


FIG. 43. Peritoneal incision is enlarged as the abdominal wall is lifted away from the viscera.

Enlargement of the peritoneal incision downward is done under direct vision, care being exercised to avoid the bladder.

Special care must be taken in entering the peritoneal cavity when there has been a previous laparotomy; when the bladder is distended or possibly displaced upward by a tumor; when there is a large tumor such as a fibroid or an ovarian cyst pressing tightly against the parietal peritoneum, and when the history suggests previous peritonitis and particularly tuberculous peritonitis. When there has been a previous operation and one is entering the abdomen through the old scar, it is desirable, if possible, to enter the peritoneal cavity at a higher point than the scar of the former operation. When a large tumor presses tightly against the parietal peritoneum, the best maneuver is to attempt entrance above the tumor. If this is not possible, the smallest nick into the peritoneum is made. If the tumor is not adherent, this will permit the inrush of air into the peritoneal cavity and from then on the peritoneum can be cut easily after elevating it from the tumor. With the bladder displaced upward, the surgeon may suspect that he is cutting into it when the tissue seems to be too thick for peritoneum and appears muscular and vascular. Upon encountering such tissues, it is well to abandon entrance at that point and to attempt opening the peritoneum at a higher point. When tuberculous peritonitis of the dry type has plastered the loops of intestine against the parietal peritoneum, the greatest caution must be exercised in entering the cavity. As soon as the surgeon gets the impression that he is cutting into muscular tissue which might be bowel wall, it is well to attempt an entrance elsewhere.

Having entered the peritoneal cavity, the abdominal walls are retracted with wide-bladed retractors. With the patient in the Trendelenburg position, the intestines usually fall back into the abdomen, if the patient is anesthetized properly. Then only one strip of gauze may be laid over them to catch blood that otherwise might run back into the upper peritoneal cavity. If the intestines do not, of themselves, fall back, packing may be necessary. Some operators prefer using a moistened rubber sheet over which a moistened

gauze pack may be placed. Others place the moistened pack directly over the intestines. The packs never should be used dry but should be wrung out of warm physiologic saline solution, a basin of which always is kept on the instrument table.

#### LOWER-RIGHT OR LEFT-RECTUS INCISION

The lower-right or left-rectus incision is not often used in gynecology. Occasionally, a right-rectus incision is made when an appendectomy is to be done in a case on which doubt exists about the diagnosis, there being considerable suspicion of right adnexal disease. In our experience we rarely find this incision necessary because of these circumstances, for if the signs and the symptoms point most to appendiceal disease a gridiron incision is made. If the evidence appears stronger for adnexal disease, a mid-line incision is made. If adnexal disease, requiring surgery, is found through the gridiron incision, it can be enlarged. Occasionally, a left-rectus incision is made in gynecology. It is used for the Mikulicz operation for sigmoidal carcinoma and for sigmoidostomy. The lower-rectus incisions are made through the same structures as the lower-mid-line incision, except that the anterior-rectus sheath fibers are cut as they cross the line of incision obliquely and not at the linea alba. The rectus muscle is deflected medially, and the peritoneal cavity is entered as in the mid-line.

#### PFANNENSTIEL INCISION

The original Pfannenstiel incision is a transverse incision from 10 to 15 cm. long, above the symphysis, through the skin and the anterior-rectus sheath, down to the rectus and the pyramidalis muscles. The rectus muscles are separated from the anterior sheaths easily by blunt dissection with the finger. A tendinous median sagittal septum dividing the rectus muscles must be cut with the scissors. Retracting the sheath of the rectus upward, the rectus muscles are separated in the mid-line, and the peritoneal cavity is entered.

We have utilized the Pfannenstiel incision occasionally but prefer a modification of it under certain circumstances. This modified incision is shown in Figure 44 A. A slightly curved transverse incision is made just below

the hairline through the skin and the fat. The fascia is cleaned of fat upward and downward, until a sufficiently long area is exposed in the mid-line to permit a sagittal incision in the linea alba. Separation of the rectus muscles and entrance in the peritoneum is made, as in the ordinary mid-line incision (Fig. 44 B). Uterine suspensions, simple hysterectomies, salpingectomies and removal of small ovarian cysts can be done through this modified Pfannenstiel incision quite satisfactorily, although exposure is usually not quite as adequate as through the usual mid-

line incision. If more room is needed than was anticipated, extension of the incision may be difficult. From the surgeon's point of view, there is no advantage in this incision, but when a patient particularly requests a "scarless" operation one is justified in using the modified Pfannenstiel incision, provided that the intra-abdominal operation is of a type that can be done through it.

#### TRANSVERSE INCISION

The transverse incision is preferred by some gynecologists and in certain cases can

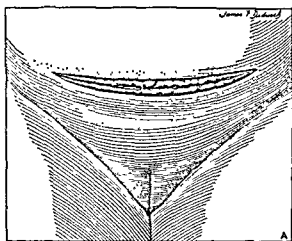
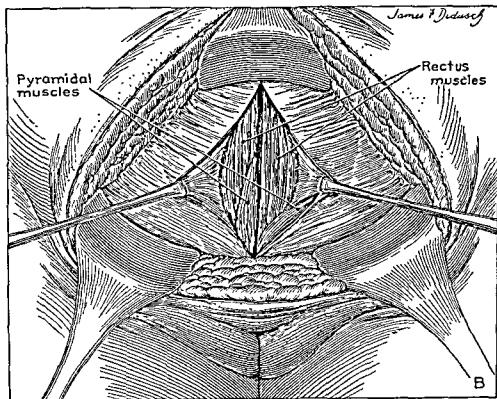


FIG. 44. Modified Pfannenstiel incision. (A) Skin incision just below hairline. (B) Mid-line incision has been made through fascia, exposing rectus and pyramidalis muscles.



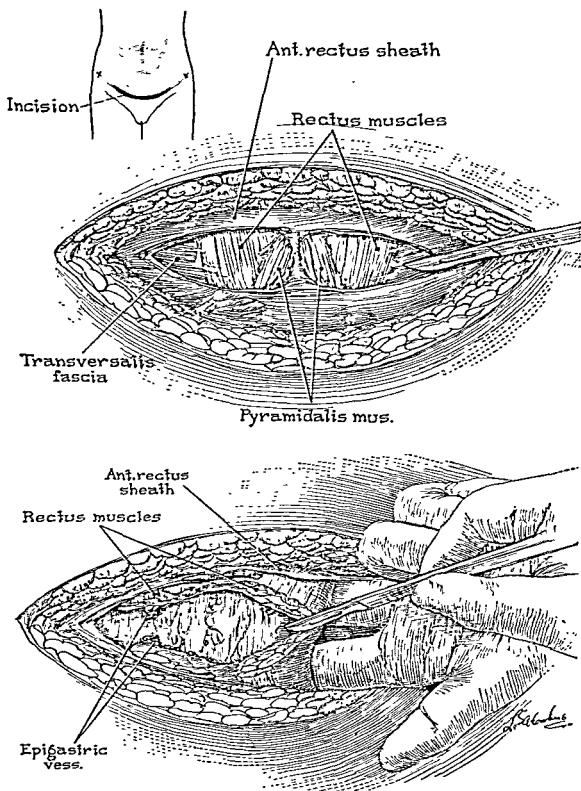
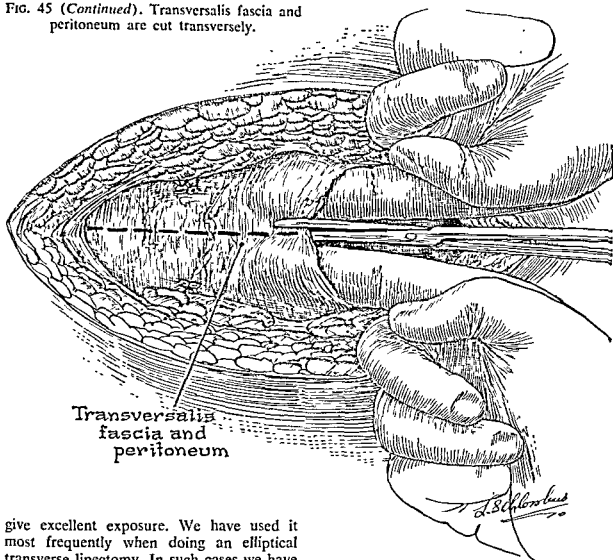


FIG. 45. (Top) The inset shows the incision which may be carried as far laterally as desired. The fascia is cut transversely, exposing the rectus and the pyramidalis muscles. (Bottom) The rectus muscles are cut transversely. The deep epigastric vessels are ligated and cut. Transversalis fascia is exposed.

FIG. 45 (Continued). Transversalis fascia and peritoneum are cut transversely.



give excellent exposure. We have used it most frequently when doing an elliptical transverse lipectomy. In such cases we have continued the *transverse cutting of the fascia and the muscles* as shown in Figure 45. It should not be used when doing hysterectomy for very large fibroids extending above the umbilicus. The method of making the incision is illustrated in Figure 45. In closing the incision we prefer figure-of-eight sutures, including the fascia and the muscles in the same bite. It is difficult to close the muscle separately for the sutures tear through with tightening. Number 1 chromic catgut is used for closure.

#### GRIDIRON INCISION

The gridiron incision is our choice for appendectomy and occasionally for the removal of small nonadherent ovarian cysts. We also use it for extraperitoneal drainage of broad ligament abscesses, following delivery and abortion, when the abscess has developed in the upper portion of the broad

ligament. In such instances the same incision is made as for appendectomy, except that it generally is made at a little lower point, and it stops short of entering the peritoneal cavity. When drainage becomes necessary during a pelvic laparotomy done through a mid-line incision, a small gridiron incision is also useful for the placing of cigarette drains. We prefer to avoid drainage through a mid-line incision, and when the necessity for it arises, it is our custom to close the mid-line incision without drainage and to place the drains through a small right or left gridiron incision. There is still another occasion when we find the gridiron incision useful. In treating gonococcal tubal infections there are infrequent cases associated with large tubo-ovarian abscesses, which extend high out of the pelvis and do not respond to chemotherapy or diathermy. The pelvis is "frozen,"

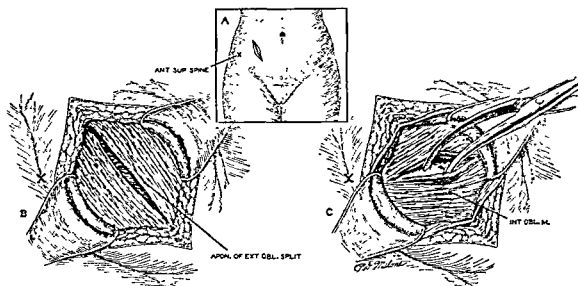


FIG. 46. Gridiron incision, opening. (A) Position of incision. (B) Aponeurosis of external oblique has been split. (C) Internal oblique muscles being split with Kelly clamp.

and to attempt removal of the tubo-ovarian abscess would subject the patient to unjustified risk. The abdominal drainage of such an abscess, through a muscle-splitting incision made directly over the abscess, permits entrance to the abscess without soiling the gen-

eral peritoneal cavity and allows the abscess cavity to collapse and heal. Often, at a later time, pelvic laparotomy is necessary. Such cases are rare, and we do not wish to create the impression that we habitually drain tubo-ovarian abscesses abdominally, but in a ward service where great numbers of pelvic infections are treated, we occasionally encounter a case in which this procedure is indicated.

The gridiron incision is made obliquely downward and inward over McBurney's point (Fig. 46 A). Variations in the location of the incision may be made when it is done for appendectomy during pregnancy and when used for abscess drainage as mentioned above. The incision is carried through skin and subcutaneous fat down to the external oblique aponeurosis. The fibers of the aponeurosis are cut in the direction in which they run (Fig. 46 B), and the internal oblique muscle is exposed by retracting the aponeurosis. The internal oblique fibers and those of the transversus abdominis are parted in the line of their fibers (Fig. 46 C). In this site the direction of the internal oblique fibers and the transversus abdominis are the same, and no attempt is made to separate the internal oblique layer from the transversus. The retractors are placed so as to retract these muscles, and the preperitoneal fat is exposed. This is incised, and then the peritoneal cavity is entered. The cecum lies

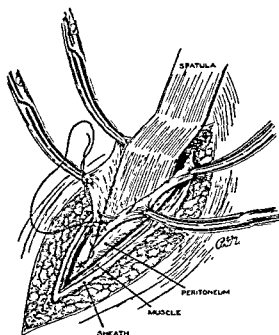


FIG. 47. Demonstrating method of closure of peritoneum which results in everted peritoneal edges.



very close to the peritoneum at this point, and more care must be exercised in entering the peritoneal cavity here than in the mid-line.

### CLOSING THE ABDOMEN

After completion of the pelvic operation the sigmoid is thrown over the field of pelvic operation to prevent the small intestines from becoming adherent to the recently traumatized operative field. The omentum is drawn down over the viscera, and the peritoneum is closed.

#### MID-LINE INCISION

In closing the mid-line incision the peritoneal closure is begun at the upper end,

suturing both the peritoneum and the posterior sheath of the rectus muscles together, using a continuous suture of No. 2 plain catgut. This rather coarse catgut is used for the peritoneum not so much for its strength as because it is heavier and more pliable; thus, it is less apt to tear through the peritoneum. The stitch used should evert the cut peritoneal edges to make the intraperitoneal suture line as smooth as possible (Fig. 47). With today's better anesthesia, usually little difficulty is experienced in keeping the intestines out of the field, if the peritoneal edges are grasped with Kelly clamps and held up and together as the operator sews. If the intestines do interfere with closure, they may be held back with a spatula, a tablespoon,

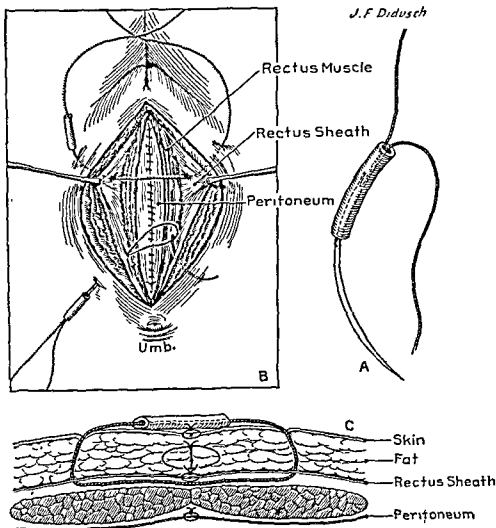


FIG. 48. Method of placing tension sutures. (A) Long cutting needle threaded with braided silk and shod with rubber tubing. (B) Method of placing sutures through skin, fat and fascia. (C) Layer-for-layer closure of abdomen and position of tension suture.

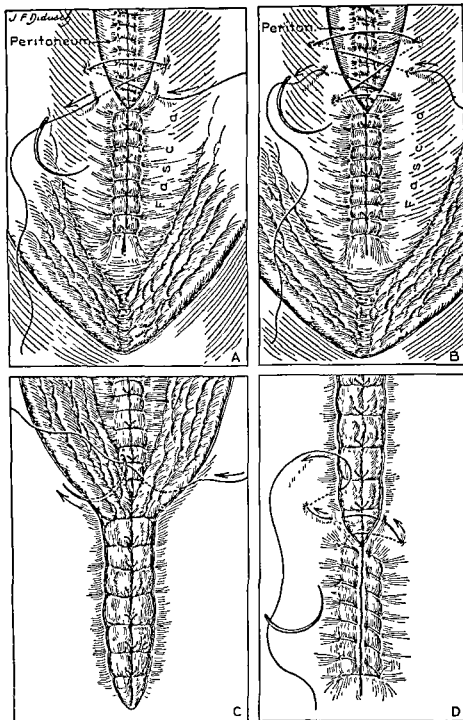


FIG. 49. Layer-for-layer closure of abdomen. (A) The peritoneum has been closed with a continuous catgut suture. The fascia is being closed with horizontal figure-of-eight sutures. (B) Double horizontal figure-of-eight suture. (C) Fat is approximated with interrupted sutures of fine catgut. (D) Skin is approximated with a continuous on-end mattress suture of fine silk.

or, if great difficulty is experienced, a Mikulicz pad may be inserted over the intestines and withdrawn just before completion of the closure.

After closure of the peritoneum, we routinely place 2 or 3 tension sutures of braided silk. These sutures pass through the skin, the fat and the fascia, but to prevent bleeding they avoid the muscles (Fig. 48 B). Small pieces of fine rubber tubing are placed on each suture to prevent cutting of the skin by the sutures when tied (Fig. 48 C).

The muscles are not sutured together in the mid-line incision unless there is sufficient diastasis to cause symptoms. In that case, a special closure is carried out as indicated on page 816. In the routine closure the fascia edges are approximated with single or

double horizontal figure-of-eight sutures, using No. 1 chromic catgut. The choice of single or double figure-of-eight sutures may be left to the preference of the operator. It is our custom to use double figure-of-eight sutures when the patient is relatively thin, and single figure-of-eight sutures in fatter women when there is greater strain on the abdominal wall. If speed is essential because of the condition of the patient, closure can be done more quickly with the double figure-of-eight stitch than with the single. These stitches are shown in Figure 49.

After closure of the fascia, the subcutaneous fat is approximated with interrupted sutures of No. 000 chromic catgut, and the skin is closed with silk, using the stitch preferred by the operator (Fig. 50). Section A

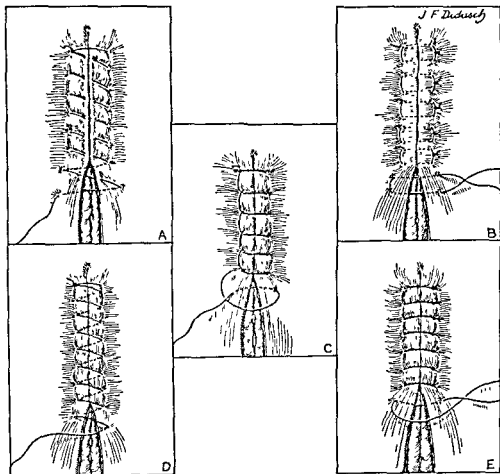


FIG. 50. Skin sutures (silk). (A) Continuous on-end mattress suture. (B) Interrupted mattress sutures. (C) Lock suture. (D) Plain continuous suture. (E) Plain interrupted sutures.

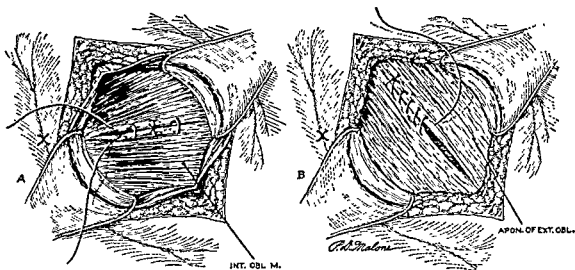


FIG. 51. Gridiron incision, closing. (A) Internal oblique fibers approximated with figure-of-eight sutures of No. 0 chromic catgut. (B) Aponeurosis of external oblique is closed with continuous sutures of No. 0 chromic catgut.

demonstrates skin closure with a continuous on-end mattress suture. This favorite skin suture of ours requires a little more time than the simple continuous suture, but it makes an excellent closure and is particularly useful when one is dealing with the lax skin of a parous woman, since it prevents inversion. Figure 50 B shows an interrupted horizontal mattress stitch. Figure 50 C shows the method of closing the skin with a lock stitch. We prefer the lock stitch when hemostasis is desired because of bleeders in the skin which are too superficial to lend themselves to buried ligatures. The lock stitch also has the advantage of being removed easily. Figure 50 D demonstrates the simple continuous suture which is quite satisfactory when the texture of the skin is firm. Figure 50 E demonstrates the simple interrupted stitch. The interrupted stitches are placed with straight intestinal needles instead of the usual skin needle. They make an ideal skin closure, though generally they are considered too time-consuming for closure of long gynecologic incisions. We frequently use the interrupted sutures for closure of the gridiron incision and, at times, for closure of the skin in a modified Pfannenstiel incision.

#### LOWER-RIGHT OR LEFT-RECTUS INCISION

The lower-right and left-rectus incisions are closed exactly as the mid-line incision.

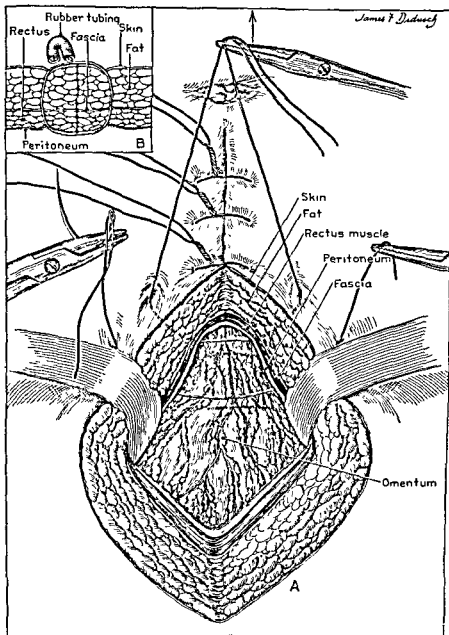
#### MODIFIED PFANNENSTIEL INCISION

The peritoneum and the fascia of the modified Pfannenstiel incision are closed as in the mid-line incision, but tension sutures are omitted. Special attention should be directed at closure of the subcutaneous fat in this incision. All dead space should be obliterated, and sutures of No. 000 chromic catgut are used to tack the flap of fat down to the subjacent fascia before the cut edges of the fat are sutured to each other. The skin is closed according to preference.

#### GRIDIRON INCISION

The gridiron incision may be closed with lighter catgut than the mid-line incision, because anatomically it is more nearly correct, and strain on it tends to draw the separated muscles and the aponeurosis edges together. The peritoneum is closed with a continuous suture of No. 2 plain catgut. The internal oblique and the transversus abdominis are closed as a single layer, using horizontal figure-of-eight sutures of No. 0 chromic catgut (Fig. 51 A). The fibers of the aponeurosis of the external oblique are closed with a continuous suture of No. 0 chromic catgut (Fig. 51 B). The fat and the skin are closed as usual. Frequently, we close the skin of this incision with interrupted sutures of fine silk, by which a beautiful approximation can be obtained.

FIG. 52. Secondary closure of disrupted wound with through-and-through silver-wire sutures. (A) Method of closure. (B) Showing suture twisted tight and approximating the wound edges.



#### SECONDARY CLOSURE OF DISRUPTED WOUNDS

Disruption of abdominal wounds is discussed in the section on postoperative complications, but the method of closure is illustrated here. It is generally agreed by students of the subject that secondary closures after evisceration are best done in a through-and-through manner rather than by the layer-for-layer method. The condition of the margins of the wound does not lend itself well to layer-for-layer closure; it is advantageous to avoid placing foreign material directly in the infected wound proper; through-and-through closure is faster, and statistics

show that the percentage of recovery is greater than when layer-for-layer closure is attempted. We have found fairly heavy silver wire to be the suture material of choice. The method of placing these sutures is illustrated in Figure 52. The wires are inserted and held up but not twisted closed before all the wires are placed. This pulls the abdominal wall away from the viscera and guards against injury to the bowel. The silver-wire sutures are placed about an inch apart. When closed by twisting, the skin is fairly well approximated, but if more careful approximation is desirable, interrupted silk sutures may be placed between the silver wires.

# Postoperative Care and Complications

## ROUTINE POSTOPERATIVE CARE

From the patient's point of view nothing is more important than postoperative care. In certain operations the success or the failure of the surgeon's efforts depends almost entirely upon the patient's receiving proper postoperative attention. This must be left, in a great measure, to the resident and the nursing staff, the training of whom falls upon the surgeon. They should be made acquainted with the early signs and symptoms of complications so that prompt treatment may be instituted. In addition, the nursing and the resident staff should be thoroughly familiar with the many little attentions that make convalescence more comfortable.

## DRESSINGS

The postoperative care of the patient begins at the operating table with the application of the sterile dressings. It is our custom to cover the entire abdomen with broad strips of adhesive, both at the operating table and at subsequent dressings, while the patient remains in the hospital. This complete dressing gives very firm support to the abdomen and permits the patient to move herself in bed with relatively little discomfort. It is particularly important for women with large, pendulous abdomens to be given this support. Since using the extensive adhesive dressing we have practically abandoned the Scultetus binders which have a great tendency to become loosened and work up onto the chest. Occasionally, a patient is sensitive to the zinc oxide of ordinary adhesive tape; sometimes she is aware of this from previous experience. When a patient warns of this sensitivity it is well to take heed, for very serious skin rashes can result in sensitive individuals. In such cases the dressings may be held in place by Scotch tape, or a single layer of gauze may be laid over the

wound and saturated with collodion. After drying, this can be reinforced with an abdominal binder. The objection is sometimes made that respiratory movements are restricted when the abdomen is completely covered with adhesive tape, causing an increased incidence in postoperative pneumonia. We have not noted this; in fact, we have had fewer cases of postoperative pneumonia than any other comparable service in the hospital. A snugly placed abdominal dressing allows the patient freer movement with relative comfort, and we believe that this reduces the incidence both of pneumonia and of phlebitis.

After a sterile dressing has been applied in the operating room, it need not be changed until the silk sutures are removed from the skin on the 7th postoperative day unless an elevation of temperature demands that the incision be inspected. Removal of the adhesive can be made quite painless by using ether or acetone on the tape before removing it. The skin should be painted again with tincture of benzoin before the broad adhesive is reapplied.

After the dressing has been applied in the operating room, the patient is transferred to a bed-stretcher and taken to the recovery room. There nurses, especially trained in immediate postoperative care, take charge of the patient. The average patient is left in the recovery room until the next morning, when she is transferred to her ward or room. If her condition is not satisfactory, she remains in the recovery room until it is.

## ROUTINE ORDERS

Certain routine orders are left in the operating room before the patient leaves. It is understood that no routine orders are perfect, and that variations must be made from case to case. However, routine post-

operative orders are quite satisfactory in at least 90 per cent of gynecologic operations, and they greatly facilitate the work of the hospital staff.

Sedation, adequate for the remainder of the day of operation, should be included in these orders left in the operating room. In a hospital well staffed with competent interns, orders for sedation for more than the day of operation need not be left in the operating room, but when the surgeon is working in a hospital which is not staffed adequately with house officers, a p.r.n. order for sedation may be advantageously left. Unless there is some idiosyncrasy, we use morphine sulfate in dosage of 10 to 16 mg. When morphia is contraindicated, we prescribe Demerol in dosage of 50 to 100 mg. or Schlesinger's solution in dosage of 0.3 to 0.5 ml. Although Schlesinger's solution contains morphia, it frequently can be well tolerated when morphia alone cannot. In leaving orders for sedatives, we believe that sufficient should be ordered to keep the patient relatively comfortable. The actual dosage of any of the above sedatives should be enough to accomplish this, bearing in mind while giving the drugs the symptoms which suggest overdosage. During the first 2 days, and often the 3rd, of convalescence, we are rather liberal with the above sedatives, but after that time codeine sulfate usually may be substituted for stronger sedatives. Small doses of phenobarbital are very helpful during the day. Nembutal and Seconal are excellent sedatives for night use. Not infrequently, small doses of these drugs may be administered advantageously during most of the hospital stay. Occasionally, patients will demand hypodermics after there is reason to believe that the physical pain does not warrant them. Such patients should be examined thoroughly to determine whether or not there are any complications to cause real pain. If none is found, every effort should be made to wean the patient away from the stronger hypodermics, substituting codeine and, even on occasion, testing the patient by substituting hypodermic injections of sterile saline.

#### CARE OF THE GASTROINTESTINAL TRACT

Orders for routine diet for the first several days should be left in the operating room at the conclusion of the operation. There is

much difference of opinion among surgeons as to the best method of feeding patients after operation. We belong to the conservative school, feeling that feeding too soon or too much is apt to increase postoperative discomfort. Due to the improvement in anesthesia, postoperative nausea has been greatly reduced, but the gains of the anesthetist may be nullified by unwise feeding. Our routine diet, which we believe applies to a great majority of major gynecologic cases, consists of tap water *ad lib* for the 1st and the 2nd postoperative days; that is, the day of operation and the next day. In our opinion this is tolerated much better than ice water; if cracked ice is left at the bedside, often it is taken to excess, together with a quantity of air, and vomiting results. Warm water is soothing to the gastrointestinal mucosa and stimulates peristalsis. The routine diet calls for liquids on the 3rd day, exclusive of fruit juices, cocoa and milk. These sugar-containing drinks increase distention. On the 4th day full liquid diet is allowed, but we discourage sweet liquids. On the 5th day limited soft diet is permitted, and on the 6th day full soft diet. Often the first solid food permitted is dry toast, usually given with tea. The routine diet calls for full diet on the 7th day.

It should be understood that the above diet is only routine; frequently, it must be altered. Many patients are able to progress to a normal diet more rapidly; occasionally, due to persistent vomiting and/or distention, progress is slower.

After a minor gynecologic operation, such as curettage, the order for "diet as tolerated" is left in the operating room. Since using Pentothal Sodium anesthesia, it is a rarity for a patient not to be able to take full diet on the day of a minor gynecologic operation.

Postoperative nausea is rarely a problem today, as compared with the days of ether anesthesia; however, it may be troublesome. Trilafon is useful in allaying this in 5 mg. doses intramuscularly. It may be given in this dosage as often as every 4 hours. During the first 24 hours we have found it to be a useful procedure to alternate Trilafon and morphine at 4 hour intervals. Later dramamine in 50 mg. doses and Trilafon in 4 mg. doses given orally are often useful for persistent nausea.

Patients who are receiving radium treat-

ments are particularly susceptible to nausea. Although this is a minor operative procedure, we routinely give them a full liter of glucose, and if nausea persists we repeat this intravenous feeding.

Certain routine orders for the care of the lower intestinal tract should be left in the operating room. A p.r.n. order covers the use of rectal tubes and enemata. The rectal tube is of great value, and by using it properly many patients get through the entire postoperative course without distention and without enemata, except for perhaps one at the time of the first bowel movement. Too frequent enemata, even of the blander kind, irritate the rectum; often they can be avoided by the use of the rectal tube. At times it is necessary only to overcome the anal sphincter spasm, and this can be done quite satisfactorily with the rectal tube alone. Our routine first postoperative enema consists of 170 cc. of water and 30 cc. of glycerin or of the prepared and easily administered Fleet's enema. This is given on the morning of the 3rd day unless contraindicated for some particular reason. No order for larger enemata, such as soapsuds, is left at the operating table, but they are given after the 4th day, if distention exists. The old fashioned enema of 240 cc.'s of milk and 240 cc.'s of molasses may be very effective in combating distention.

No routine cathartic order is left in the operating room, for we feel that better results can be obtained by suiting the cathartic to the individual patient. Indeed, an occasional patient requires no postoperative cathartic. In general, we do not prescribe any more drastic cathartics than are necessary to be effectual. Hence, we do not subscribe to the routine use of drastic cathartics such as castor oil. Often some idea of the laxative necessary to be effectual may be obtained by talking to the patient about the condition of her bowels before operation. If she has been in the habit of taking a nightly cathartic, one should start postoperatively with a more drastic cathartic than in the case of an individual who has been spontaneously regular in her bowel habits. Usually on the evening of the 3rd day a running order is left for an ounce of milk of magnesia each night. Often

this, combined with enemata, is all that the patient requires. If these laxatives are not successful they may be increased in dosage, or more drastic ones may be used. We seldom use cathartics as strong as castor oil, but there is an occasional patient in whom inability to have a satisfactory movement results in discomfort and distention up to the 6th or 7th day after operation. In such a patient a dose of castor oil is effective and often clears up all distention promptly. Finally, glycerine suppositories may be found to be most useful in certain individuals.

Before the patient leaves the operating room, the anesthesia sheet, bearing a record of the anesthesia, should be completed. It is the custom for the operator to dictate to the anesthetist the name of the operation and special notes on the findings, which will be of use to him later in making a complete record of the operation. Also, the number and the type of drains and packs should be noted on the anesthetist's chart. When possible, the best method of recording complete operative notes is to have the operator dictate full notes to a secretary in the operating room, while closing. Exact details of operations dictated after several days often become hazy to the busy surgeon, especially when his work lies in a special field where he frequently does several similar operations.

As soon as these details have been carried out and, in addition, certain procedures for the care of the bladder have been taken care of, as described elsewhere in this chapter, the patient is sent to the recovery room. In the transfer from the operating table care must be taken that arms, legs and the head, as well as the torso, are well supported, since the patient is dead weight, and serious injury to dependent parts may result from sudden release of support. The patient should be covered with a cotton blanket to absorb perspiration, and in cool weather sufficient woolen blankets should be used to protect her. She should be accompanied in her journey to the recovery room by a responsible member of the house staff, or by the anesthetist. Sudden change in blood pressure, respirations and pulse should be watched for and, in such an eventuality, appropriate treatment should be started immediately.



### ARRIVAL IN THE RECOVERY ROOM

On arrival in the recovery room the patient's condition is again checked by the house officer or the anesthetist, and her care is turned over to the nurse in charge. All of the routine postoperative orders should be transferred to the nursing care cards. A special chart is started by the nurse on which the blood pressure, the pulse and the respirations are recorded frequently; the temperature is taken every 4 hours. Stimulants, medication and fluid intake and output are also recorded in special columns, and at frequent intervals the nurse makes her notes on the condition of the patient. Intravenous fluids are administered routinely to all patients who have been subjected to laparotomy or an extensive plastic procedure. In the average case a flask of 1,000 cc. of 5 per cent glucose in water is started to run in slowly at operation. This is completed in the recovery room and in most major cases is followed by a second similar flask. Saline solution in quantity equivalent to 4 to 6 Gm. should be supplied during the first 24 hours. This does not represent the normal salt intake of a healthy adult, but since salt is retained to some degree postoperatively, these amounts suffice. Maintaining a salt balance should be kept in mind particularly during hot weather.

### AMBULATION

Early ambulation versus prolonged bed rest has been a controversial subject for years. Even at the turn of the century the subject was debated. Following this, most surgeons practiced prolonged bed rest until the past 2 decades; since then there has been great enthusiasm on the part of some surgeons for early ambulation. Some of this has resulted from the great demand for hospital beds. It is easy to yield to the idea when one is pressed for beds by demanding patients. One of the hopes in early ambulation lay in the idea that thrombophlebitis and embolism would be reduced. An unprejudiced review of the literature will show that there has been no reduction in these phenomena by early ambulation. For those patients who are required to remain in bed for several days it has been our custom to

strap the abdomen well with broad strips of adhesive tape. This puts the tissues in the region of the incision at rest but permits the patient to move in bed with the minimum of discomfort. We encourage movement of the lower extremities and frequently place a small pillow at the foot of the bed which the patient can use as a punching bag to stimulate circulation. There is another phase of bed rest in the protected environment of a hospital which has not been stressed, yet it is important in the field of gynecology. Most hysterectomies and plastic operations are done on women in middle life when the wear and tear of a strenuous household or social demands have had their effect. Such women welcome bed rest, and in my experience their complete recovery is hastened by a somewhat prolonged hospital stay. The hysterectomized woman who is got out of bed on the day following surgery and sent home on the 7th day may appear further advanced at that time than the woman who has remained in bed. Nevertheless, her ultimate physical and mental recovery in her own home may be more prolonged than that of the woman who has spent more time in the hospital. This is especially true today when domestic help is scarce and generally of poor quality.

Like most medical problems, there is no single answer to the question of ambulation. Each case should be evaluated individually. The woman on whom a simple vaginal hysterectomy without vaginal plastic repair has been done may be quite safely permitted to get up the day following surgery. This may promote voiding and thus generally hasten her convalescence. The woman on whom an extensive vaginal plastic operation has been done for marked prolapse and its allied conditions had better be kept in bed for 10 days. Also, a young woman with good tissue-healing potentiality on whom an abdominal suspension or adnexal surgery has been done may be got out of bed as soon as she desires. For reasons of preventing pulmonary congestion early ambulation may be advisable in the aged but in the average middle-aged woman upon whom major pelvic surgery has been done bed rest of 10 days is welcome, and in the author's opinion it is advantageous.

## POSTOPERATIVE CARE OF THE URINARY BLADDER

The care of the urinary bladder is of major importance from the standpoint of the patient's comfort after operation and, still more important, from the standpoint of the prevention of urinary-tract infection. In our experience in urinary pathology in women, we have been struck with the frequency with which patients date the onset of their chronic urinary-tract infection from trouble in emptying the bladder after operation or delivery. The pain from overdistention of the bladder or from repeated catheterizations improperly done is one of the most disagreeable postoperative discomforts that the patient has to bear. It is our belief that *improper handling of the urinary tract contributes more to the patient's postoperative pain than any other single thing during that period.* This is particularly true with vaginal plastics.

Our ward routine calls for catheterization of a patient 8 hours after operation, if she has failed to void 100 cc. or more at one time. Following the first catheterization, the bladder is emptied every 8 hours, unless the patient voids 100 cc. or more at one time. In addition to the orders for catheterization in relation to time, there is a p.r.n. order for catheterization, and nurses should be taught to respect this order and not be guided entirely by time. Today with the free use of intravenous fluids the bladder is apt to require emptying much earlier than formerly. *No routine order for postoperative catheterization can fit every case,* but in most hospitals such a routine is necessary and serves the average case very well. The danger in a prescribed routine lies in the possibility of nurses' interpreting it too rigidly and carrying it out in spite of signs which should indicate another course. If suprapubic pain or distention suggests a full bladder, the bladder should be emptied even though the patient has voided 100 cc. or more at one time. Also, if persistent voiding of small amounts, with a frequent desire to void, suggests a full bladder with only partial emptying, the patient should be catheterized, regardless of whether or not one voiding has exceeded 100 cc. *Finally, if the patient desires and is unable to void, she should be*

*given the benefit of the doubt and catheterized, regardless of how little time has elapsed since the last voiding, and regardless of any other evidence which would seem to suggest that the bladder is not distended.* Repeatedly, we have seen a bladder relieved of from 500 to 1,000 cc. of urine a surprisingly short time after voiding a good quantity, or even shortly after the bladder has been emptied by catheterization, when the usual signs would seem to indicate that the organ could not be distended. The thought that the patient is always right makes a good rule upon which to act in respect to distention of her bladder. *Every nurse in charge of gynecologic patients should be acquainted with these facts and should be instructed to act accordingly.* In these days, when large quantities of intravenous fluids are frequently used, one should be particularly mindful of the possibility of bladder distention. Often the bladder is full of urine before the completion of giving 1,000 cc. of intravenous fluid.

It is our practice to leave an indwelling catheter in all patients while they are receiving radium treatment. The nurse should be instructed to notify the doctor if catheter drainage does not equal 30 to 40 cc. every half hour. In that case the patency of the catheter should be tested, and if necessary the catheter replaced.

Curtis has emphasized repeatedly that simple catheterization, at times other than in the postoperative period, is relatively harmless. Our experience confirms his view. In our outpatient department and in private practice we pass catheters several times each day to obtain urine for diagnostic purposes. We have had no reason to believe that this procedure, properly done, has been responsible for urinary-tract infection.

Our technic of catheterization is simply to swab the urethral meatus with 2 successive toothpick swabs, which have been dipped in 1-1,000 aqueous Merthiolate solution or Zephiran. With this technic the bacterial flora about the meatus is reduced, but we do not claim for it complete sterilization of the meatus, and certainly not of the outer urethra. Undoubtedly, some bacteria are introduced into the bladder, but in spite of this we have no reason to believe that cystitis ever has resulted from catheterization

when this technic has been followed in the office or the outpatient department. The ability of the patient to empty her bladder completely at subsequent voidings apparently prevents the development of cystitis. In dealing with the bladder postoperatively, one is confronted with the additional factor of residual urine. Taussig has well demonstrated that residual urine nearly always exists after operations, even when the patient voids spontaneously from the beginning. He compared the total amount of urine voided spontaneously with the total amount obtained by catheter in 2 groups of 30 patients over an equal period. An average of 150 cc. more of urine was obtained by catheter from each patient. It has been demonstrated innumerable times by all who practice catheterization after the resumption of voiding that residual urine exists for a time postoperatively in most patients who have required one or more catheterizations. Once one has catheterized a patient postoperatively and presumably introduced a few bacteria, it becomes important to prevent residual urine on resumption of voiding. If the frequent voiding of small amounts or quickly recurring bladder discomfort after voiding of even larger amounts suggests incomplete emptying of the bladder, the patient should be catheterized at least once daily until the residual is reduced to 100 cc. or less for 2 successive days.

From the above discussion it is apparent that the promotion of spontaneous emptying of the bladder and the prevention of catheterization is very desirable. Various procedures and medications have been used for this. Most of the methods of promoting voiding are concerned with inducing the bladder to empty itself after postoperative retention has occurred. The usual procedures of running water, putting warm water in the bedpan, giving enemas, irrigating the perineum and elevating the patient to a partially sitting position are known to all surgical nurses. They have undoubted value, especially in those cases in which the psyche plays a role. Drugs are used to promote voiding, and at times they seem to be of value, but often the results are disappointing. Furfurthide in dosage of 10 mg. by mouth 2 or 3 times a day or a single dose of 5 mg. hypodermically may

help. Also, Urecholine in dosage of 10 mg. 2 or 3 times a day seems at times to promote voiding. But the perfect drug which always can be relied upon has not yet been discovered.

Since 1925 we have been using in our clinic a procedure that has for its purpose the prevention of bladder distention rather than the promotion of voiding after distention has occurred. The procedure consists of the instillation into the bladder of 30 cc. of 0.5 per cent aqueous solution of Mercurochrome at the conclusion of the operation while the patient is still on the operating table. The originator of the idea that a bladder instillation of Mercurochrome might facilitate postoperative voiding is not known to us.

The results of our early experiences with this procedure were first reported by Craig in 1930, and our experience with a much larger series of cases was reported by Woodruff and Te Linde in 1939. Because we believe that this simple procedure has been of such great value in promoting the patient's postoperative comfort, we shall give our results in some detail.

In our series of 500 pelvic laparotomy patients who were given the Mercurochrome bladder instillations only 6.6 per cent required one or more catheterizations. In a control series from another hospital, 51 per cent required catheterization. Thus by this simple procedure catheterization was reduced to almost one eighth. The time and the amount of the first voiding are instructive in reference to the completeness of emptying the bladder. For 551 laparotomy patients who received our routine treatment, the average time of the first voiding was 5 hours and 30 minutes. For a control series, the average time of voiding was 9 hours and 26 minutes. For a series of 495 patients receiving the bladder instillation, the average amount of the first voiding was 194 cc., whereas for a control series of 125 patients who voided without catheterization the average amount was 168 cc. If one adds to the 168 cc. the 30 cc. of Mercurochrome solution that was instilled into the bladder, the two figures are approximately the same. These data indicate that by means of this routine the patients empty their bladders more completely, for in 5½ hours they

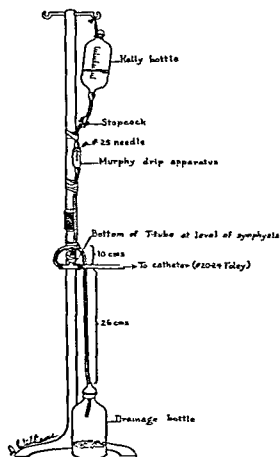


FIG. 53. Tidal drainage device.

voided an amount of urine equal to that which was voided in almost double that time by patients of a control series. Since complete emptying of the bladder is of such great importance in preventing urinary infection, we believe that this accomplishment is a strong point in favor of this procedure.

We believe that the Mercurochrome instillation is effective because of its irritating effect upon the bladder mucosa. Occasionally, a little microscopic blood appears in the first specimen, but in only one case in our series was there gross hematuria. Often the patient calls for the bedpan before she is completely recovered from the anesthesia,

bladder symptoms. In all 3 of these there was a history of previous urinary-tract infection. In a control series of 249 laparotomies from another hospital, there were 5 cases of clinical cystitis and 2 cases of pyelitis. From these data we believe that we are justified in concluding that urinary-tract infections are less frequent in patients treated by this routine.

The postoperative care of the patients on whom vaginal plastic operations are done is not as satisfactorily worked out. We have not found the instillation routine to be of any value in promoting voiding in this group. Fifty-eight per cent of the vaginal plastic patients required catheterization, and in a group of patients on whom the interposition operation was done 72 per cent required catheterization. In simple perineal repairs, rectocele operations and vaginal hysterectomies without anterior wall repair we do not customarily use indwelling catheters, but when an extensive cystocele repair, Manchester operation or Spalding-Richardson composite operation is done we insert a Foley catheter at the conclusion of the operation. This is usually left in the bladder until the morning of the 5th postoperative day. Then it is removed, and the patient has an opportunity to void. We frequently start a course of Urecholine Chloride or Furmethide the night before operation. If she fails to void, a retention catheter is inserted after several catheterizations. In these women who have continued difficulty we frequently set up a tidal drainage apparatus so that the bladder musculature may be exercised. As a matter of fact, Williams and Julian have just concluded a study on our service, using tidal drainage directly after surgery on the anterior vaginal wall, with and without vaginal hysterectomy. These cases required an average of 3.7 catheterizations following discontinuance of tidal drainage on the 5th postoperative day. A control group on whom a simple Foley indwelling catheter was used directly after surgery until the 5th day required an average of 11.1 catheterizations. Furthermore, the tidal drainage group required an average of 2 days after withdrawal to empty the bladder to the point of a satisfactory residual, whereas the control group required an average of 4.1 days. There was no increase in the incidence of bladder infection in the tidal drainage group over the

group in which a simple indwelling catheter had been used. The tidal drainage device which we have used and found to be satisfactory is shown in Figure 53. Although we regard this as a preliminary study, it suggests that immediate postoperative tidal drainage may reduce the catheterizations considerably. While a retention catheter is in the bladder, fluids are forced. In spite of this, a certain amount of infection frequently results, and for a few days after removal there is frequency, urgency and often some dysuria. *Escherichia coli* is the organism most frequently responsible. Full therapeutic doses of Gantrisin are then given in an attempt to eradicate the infection; both the infection and the symptoms of bladder irritability are usually short-lived when treated in this manner. However, infection and symptoms sometimes persist; therefore, it is well to culture and test for sensitivity the urine at the onset of symptoms in all cases so that in case the infection does not clear up promptly the indicated antibiotic may be given. When there is much irritation after removal of the catheter, the instillation of 30 cc. of 5 per cent Intracaine in oil gives relief, and the relaxation of vesical-neck spasm promotes voiding.

### SHOCK

Traumatic shock has been defined as an oligemia (diminished blood volume) initiated by traumatic local fluid loss of either whole blood, plasma, or both, into the injured tissues or elsewhere. It is accompanied by decreased cardiac output, diminished volume flow, lowered venous pressure, decreased oxygen consumption, arteriolar vasoconstriction, progressive hemoconcentration, capillary congestion and secondary blood-pressure fall. Once the blood or fluid loss has become too great and has persisted too long, it is an irreversible process.

There are many theories regarding the cause of shock; none of the present theories will explain all cases, and probably no single theory will ever answer the question of pathogenesis in all cases. Blalock states that traumatic shock usually is due to: "(1) regional loss of fluid, (2) toxemia, (3) nerve impulse, or (4) various combinations of these."

In gynecology one sees shocked patients who fall into 3 groups. The first is made up

of cases with massive hemorrhage. This may be intraperitoneal, such as one sees with ruptured tubal pregnancy or tubal abortions and less frequently with a ruptured corpus luteum. In those cases in which there has been a massive intra-abdominal hemorrhage, there can be little doubt, clinically, that loss of blood is the important etiologic factor. However, one cannot entirely ignore the acute and severe pain which occurs as a result of the tubal accident. This pain not infrequently causes fainting and changes in the pulse even when there has been no great loss of blood. However, such a reaction seldom lasts long enough to produce the clinical picture of shock, this being present only as a result of a massive loss of blood within the abdomen. The treatment of patients in shock from ruptured tubal pregnancy is considered in the chapter on tubal pregnancy.

Massive hemorrhage and resulting shock may also occur from submucous fibroids, cervical carcinoma and traumatic lacerations of the hymen and the vagina.

The second group—a small one—consists of patients who have suffered a traumatic or spontaneous rupture of an old tubo-ovarian abscess or pyosalpinx. These abscesses, although originally gonococcal in origin, have, in our experience, become secondarily infected with other organisms. The pain of the rupture, plus overwhelming massive peritonitis, may very rapidly produce the picture of profound shock. There is no evidence that loss of body fluids is a casual factor in these cases. Such cases are considered in more detail in the chapter on gonorrheal infections.

The third group of gynecologic patients in whom shock occurs is composed of those upon whom prolonged or bloody operative procedures have been done. These will be considered in more detail here. In most of these cases the shock results from great loss of blood, but this is not always the entire factor. At times prolonged relatively dry operations can also result in shock. Furthermore, it is a common observation that shock is less frequent after vaginal operations with considerable blood loss than after pelvic laparotomies with equal loss of blood. A point in favor of the "nerve impulse" theory of shock is the observation that operations done for huge pelvic tumors, tightly wedged

into the pelvis, when considerable traction is necessary for their removal, may produce shock without much blood loss.

### TREATMENT

**Prevention of shock** should be foremost in the mind of everyone who does major surgery. The importance of this becomes apparent when one remembers that if shock is too profound or has existed too long the pathologic physiologic processes associated with it are irreversible. The general condition of the patient should be carefully evaluated preoperatively and, if possible, corrective measures taken before undertaking the surgery. Patients with low hemoglobin, who are seen so commonly in gynecology, should be transfused repeatedly, if necessary. In the pretransfusion era it was shown by Cullen that there was a great increase in mortality in patients who were operated upon with a hemoglobin of less than 40 per cent. It is safe to assume that much of the increase which he noted was due to operative shock. There is little excuse today for undertaking a major pelvic operation upon a woman with a hematocrit of less than 30 per cent, and the more extensive the anticipated operation, the higher should the hemoglobin be elevated before attempting the operation. Preoperative typing and crossmatching of all patients upon whom major gynecologic surgery is anticipated should be routine.

Equally important in the prevention of shock is the institution of treatment in the early stages, before the definite, easily recognized signs have made their appearance. Fall in blood pressure is not considered an early sign by workers in experimental shock. On the other hand, drops in blood pressure without change in pulse rate or quality reported by the anesthetist during an operation when there is no reason to believe, either from the duration of operating or quantity of blood lost, that shock is imminent should not be regarded too seriously. Usually the use of a vasoconstrictor drug will promptly restore such a fallen blood pressure to a normal level. If the blood pressure does not rise promptly after such treatment and especially if the pulse rate increases, the fall in blood pressure should be regarded more seriously. Blalock states that "when the

arterial pressure declines in traumatic shock to the so-called critical level (approximately 75 mm. of Hg) it is a sign of advanced rather than incipient shock." Blalock further states that "a rising pulse rate is often a useful indication of developing shock, but peripheral circulatory failure may exist when the pulse rate is 80 or less. A falling blood pressure is the best single index of progressing shock, but, as stated previously, it is not an early sign of traumatic shock." Peripheral signs of shock should also be given consideration in evaluating the patient under anesthesia such as cold moist skin.

**Intravenous Fluids.** The above observations translated into thoughts for the surgeon at the operating table mean this: whenever the duration of the operative procedure, its magnitude, and/or the loss of blood indicate that shock may possibly develop during or following the operation, treatment in the form of intravenous fluids should be instituted without delay. In fact, it has become routine in our operating room to start intravenous fluids at the beginning of all major operations. The rate of flow is slow at the beginning of the operation but may be increased at the first indication of impending shock. Blood pressure should be checked routinely by the anesthetist at intervals of 5 minutes and oftener when there is an appreciable fall in the arterial pressure. The surgeon should be notified of blood pressure variations. If the patient with falling blood pressure fails to respond promptly to a vasoconstrictor drug, treatment for shock should be instituted promptly. Transfusion of whole blood is without doubt the best treatment. If there is any delay in supplying this, because of failure to group and match blood before operation, saline, glucose and/or plasma expanders may be given at once, and the blood should be given as soon as possible.

At the conclusion of the operation, if shock still exists, intravenous treatment is continued and other methods of therapy are instituted. The foot of the bed or the stretcher should be elevated; tight bandaging of the arms and the legs forces the venous blood into the circulation of vital parts. The patient should be made warm by blankets, but too much artificial heat by hot-water bottles or electric heating pads is not advisable. Arti-

ficial heat may cause sweating and vasodilation of the skin vessels and thus rob the more vital viscera of much-needed blood.

**Transfusions.** Since blood loss is the chief factor in the production of shock in most gynecologic operative cases, the logical treatment is transfusion of whole blood in quantity sufficient to bring the blood volume to normal and maintain it there. When this is accomplished, the other symptoms and signs, such as cold extremities, pallor and reduced pulse volume, will have disappeared. Failure to respond to one or two 500 cc. transfusions of blood should not deter one from progressing with further transfusions. In cases of severe shock, we have given as many more transfusions in rapid succession before there was a sustained rise in blood pressure. In war wounds, plasma and concentrated albumin were extremely useful, but there is less need for these in gynecology where treatment is always carried out in hospitals with blood available. However, plasma may be useful if the blood is not immediately available for transfusion.

Hypodermic injections of morphia or other sedatives are seldom necessary during the period of shock and preferably should not be administered. When the patient becomes restless, this usually can be taken as an indication of recovery from shock and then sedation may be used safely.

## POSTOPERATIVE HEMORRHAGE

Massive postoperative hemorrhage following either pelvic laparotomies or vaginal operations is rare today, since most modern surgeons understand the value of careful hemostasis. The author has observed only one fatal massive intraperitoneal hemorrhage on the gynecologic service of the Johns Hopkins Hospital in the past 30 years. In that instance a ligature slipped off of the ovarian vessels. On the other hand, there is slight oozing of blood into the peritoneal cavity following most pelvic operations, particularly when many adhesions must be cut. This is proved by inspection of the peritoneal cavity at autopsy in the rare case that dies during the immediate postoperative period. The absorption of such blood probably is one of the chief factors causing postoperative elevation of temperature.

**Symptoms.** When massive intraperitoneal hemorrhage takes place, the patient becomes restless, anxious and develops air hunger. The pulse becomes rapid, and the blood pressure falls to an alarmingly low level. Such symptoms occurring within a few hours after the operation may indicate delayed operative shock without hemorrhage, and it is with the greatest difficulty that it can be distinguished from hidden hemorrhage. If such symptoms develop several hours after the operation, the likelihood of hemorrhage is greater. Fairly massive intraperitoneal hemorrhage may stop spontaneously as the blood pressure drops and the blood clots about the bleeding vessel. Leukocytosis develops as a result of the intraperitoneal blood, and when infection complicates the condition, both the leukocyte count and fever mount. Palpation and percussion of the abdomen may suggest the presence of fluid blood, but often by the time the flanks are dull from the collection of blood, the hemorrhage is fatal. Pelvic examination is often helpful in detecting intrapelvic hemorrhage by disclosing bulging in the vaginal fornices or crepitation from clotted blood. Posterior colpotomy or culdocentesis may be done in attempting to ascertain the presence of intraperitoneal blood. This should be performed only when the operating room is set up for immediate laparotomy in case blood is discovered. Valuable time should not be lost while attempting to ascertain whether or not there is intraperitoneal hemorrhage. Transfusion of whole blood should be instituted on the suspicion of hidden hemorrhage. When intraperitoneal hemorrhage is proved or seriously suspected, the abdomen should be opened and the bleeding vessel quickly ligated.

**Broad-Ligament Hemorrhage.** Hemorrhage may occur postoperatively within the broad ligament and in our experience is more frequent than massive intraperitoneal hemorrhage. It usually results from retraction of either an ovarian or a uterine vessel from its suture. Pain, fever and leukocytosis are characteristic of broad-ligament hemorrhage. If the operation has been a total hysterectomy, old hemolyzed blood may eventually find its way into the vagina. As a rule, a broad-ligament hematoma requires no

operative treatment. With diathermy it usually shrinks gradually and becomes asymptomatic. If infected, a broad-ligament hematoma may be drained vaginally, or if high in the broad ligament it may be drained extraperitoneally as described in the section on postabdominal infections.

**Hemorrhage into the Panniculus.** Slight oozing into the panniculus is the most frequent hemorrhage following laparotomy, and very rarely a massive hemorrhage into the panniculus may occur. It is our custom to leave the Halsted clamps on the vessels of the panniculus while performing the operation and to remove them after the peritoneum is closed. Only those vessels that bleed on removal of the clamps are reclamped and ligated. It is inevitable that an occasional vessel that has been clamped but not religated should begin to bleed later. Such a chance is taken in not ligating every vessel in the fat, but it is better than filling the wound with catgut by ligating great numbers of minute vessels. Closure of the panniculus wound with fine catgut reduces the potential space for bleeding; hence, in our experience massive hemorrhage in the panniculus is extremely rare. The smaller hematomas in the fat usually liquefy and discharge through the incision without becoming infected. However, there is no doubt that the accumulation of blood in the wound does predispose to wound infection. Large hematomas in the wound should be evacuated through the recent incision by inserting and spreading the jaws of a clamp. Irrigations with peroxide may help to cleanse the cavity. If the accumulated blood has become infected, daily irrigations with an antibiotic solution may be advantageous.

**Hemorrhage After Amputation of the Cervix and Trachelorrhaphy.** Amputation of the cervix *per se* and trachelorrhaphy are rare operations in our clinic. In looking back 30 years one can recall rather frequent hemorrhages following these operations. They usually occurred from 8 to 15 days after the operation when the catgut began to give way and infection eroded the vessels. Such hemorrhages are often profuse, and the patient should be taken to the operating room without delay and should be anesthetized. At the stage of the convalescence at which these

hemorrhages commonly occur, the condition of the cervix is such that religation of the vessels is difficult. Deep bites should be taken through the friable tissue in an attempt to control the bleeding with mass ties. It is impossible to control the bleeding by suture, one must tightly pack gauze against the cervix. Gelfoam or Oxycel may be applied to the cervix before packing to facilitate coagulation of the blood. Today when cold conization is a more frequent operation than either of the two above-mentioned procedures, the same bleeding may be expected to occur. Indeed, several hemorrhages have been reported after conization.

**Hemorrhage After Colporrhaphy.** Postoperative bleeding from an anterior or posterior colporrhaphy usually can be located readily and resutured. When late hemorrhage occurs from a broken-down posterior colporrhaphy, on occasion we have used through-and-through silver-wire sutures which are left in from 10 to 14 days. In this manner the repair is salvaged, whereas, if suture material less resistant to infection were used, it might break down completely.

### EXCESSIVE NAUSEA AND VOMITING

A certain amount of nausea and vomiting is common after operations, but with improved methods of anesthesia these uncomfortable symptoms have been reduced to a minimum. Two decades ago nausea and vomiting commonly extended into the 3rd postoperative day. Today it is not uncommon to have no nausea or vomiting after major gynecologic operative procedures. In the average case an emesis or two occurs while the patient is beginning to arouse from the anesthesia. She is still unconscious while this takes place, and if questioned afterward she will have no recollection of it. On our service it is the exception to have the patient complain of nausea at the first visit of the surgeon on the day following the operation. However, there is an occasional patient who, regardless of the type of anesthetic, the shortness of the operative procedure and the most gentle handling of the viscera, will have persistent nausea and vomiting. In some instances, this is due to a sensitiveness to the anesthetic agent or to the postoperative



sedative. Morphia is extremely nauseating to some women, even in small dosage. Too early attempts at feeding the patient may precipitate nausea and vomiting, and once started it may persist. With the ease of intravenous feeding there is little excuse for placing food in the intestinal tract before it is in condition to utilize nourishment. In some patients the psyche undoubtedly plays a role in the vomiting as evidenced by the fact that even the threat of the passage of a stomach tube cures the condition promptly. When nausea persists, and particularly when it is combined with tympanites, one should consider the possibility of obstruction, acute gastric dilatation or peritonitis.

### TREATMENT

Prevention is the most important factor in excessive nausea and vomiting. The experience of the past several years clearly indicates that much can be accomplished by the choice of the proper anesthetic, the judicious use of preoperative and postoperative sedation, shortening of the operative time and the avoidance of the rough handling of tissues in the splanchnic area. The substitution of Demerol, Schlesinger's solution, Dilaudid or Pantopon for morphine often avoids nausea and vomiting. The preoperative statement of the patient that a certain drug nauseates her is worth heeding; that drug should be avoided by all means. The use of Trilafon, Dramamine and drugs with similar antiemetic properties may often be used to advantage.

When in the early postoperative period it appears that nausea and vomiting are likely to be excessive, all food and fluids by mouth should be withheld, and the patient should be kept hydrated and fed with intravenous saline and glucose. An ice cap to the throat and the epigastrium may help the patient to combat her impulse to vomit. Placing the patient in Fowler's position may aid. Emptying the stomach with a stomach tube may stop the vomiting. This is true especially if the vomiting is of psychical origin. If there is any tendency for the nausea and the vomiting to persist, the use of the Levin tube with thermotic low-pressure suction is extremely valuable. When nausea and vomiting persist and other signs and symp-

toms suggest ileus, appropriate treatment should be carried out. For details the reader is referred to the section on intestinal obstruction.

## DISTENTION

### ETIOLOGY

Distention or tympanites is a much less frequent postoperative complication than in former years. Twenty or more years ago it was not uncommon for a considerable proportion of postoperative patients to spend 3 or 4 most uncomfortable days with intestinal distention. Today even moderate distention is rare following gynecologic operations. What factors have brought about this improvement? At the outset it is apparent that no single factor can be named which accounts for the improvement in this postoperative complication. Anesthesia undoubtedly plays an important part. In the opinion of the author the first real reduction in the incidence of tympanites came with the introduction of basal anesthesia. Avertin greatly reduced the quantity of ether required for surgical anesthesia, and distention was decreased correspondingly. The incidence has continued to be low since Pentothal Sodium has replaced Avertin to a great degree. The improvement in anesthesia has also abolished the necessity of forceful packing back of the intestines. The lightening of respiratory excursions by the Pentothal Sodium usually makes it necessary simply to lay a piece of moist gauze over the abdominal contents when the patient is in the Trendelenburg position in order to prevent the blood from running up into the general abdominal cavity. Thus the intestines are spared the trauma of forcibly pushing and holding them out of the operative field. Minimizing trauma to the intestines as the result of a more general understanding on the part of surgeons of the necessity of careful handling of tissues also contributes to lessening postoperative distention. Reduction in operating time not only subjects the tissues to less manipulation but also shortens the anesthetic. We believe that the omission of strenuous preoperative purgation is advantageous and that the same favorable effects, without the disadvantages, can be obtained by request-

ing the patient to eat lightly on the day before operation. Opiates in some individuals cause atony of the bowel wall, and it is probable that the substitution of barbiturates to some degree for opiates has tended to reduce tympanites. Perhaps intravenous fluids have contributed as much as any single thing to the reduction of distention. Instead of pouring fluids into a dilated stomach and bowel, fluids by mouth are restricted and the necessary body fluids are supplied by the intravenous route. Finally, in considering the causes of distention one should not overlook the possibility of the swallowing of air by nervous women. Some surgeons consider this the most frequent cause of distention. We recognize it as one cause but believe that it is rarely a major factor in distention.

The distention of the abdomen may be the result of gastric dilatation, intestinal dilatation or a combination of both. It may be due simply to a loss of smooth muscle tone in these organs as a result of some of the causes considered above, but it may also be the result of peritonitis and/or ileus. When tympanites is marked, the important problem is to determine whether either of these two serious conditions is present, or both.

#### SYMPTOMS

The distended patient usually feels most uncomfortable. There is a sense of tightness in the abdomen and an embarrassment of respirations. "Gas pains" intermittently cause an aggravation of pain, but they indicate that the bowel wall retains at least some contractile power. When there is an absence of such pains, and auscultation over the abdomen reveals no sound, paralytic ileus is present. An increase in pulse rate, nausea and vomiting commonly accompany tympanites; the more pronounced these symptoms, the greater the likelihood of ileus and/or peritonitis. When, in addition, the temperature and the leukocyte count become greatly elevated, peritonitis is almost certain.

#### TREATMENT

Prevention of distention should be the aim of every surgeon, and it can be accomplished to a great degree by bearing in mind some of the causes discussed above. In cases such as ruptured ectopic pregnancy or rup-

tured tubo-ovarian abscess where distention is anticipated a course of Prostigmin or Ilopan, given every 4 hours, beginning immediately postoperatively, may be a valuable preventive measure. At the first indication of tympanites, treatment should be prompt and vigorous, for the condition is much more easily conquered early than when fully developed. A course of Prostigmin is begun immediately. Our usual order is for 1 ampule of Prostigmin, given hypodermically every hour for 3 doses, unless there is reason to suspect organic obstruction or inflammatory bowel lesions; bowel anastomosis or repair also contraindicates such stimulation. After this initial short vigorous course, the drugs are given every 4 hours as long as necessary. The rectal tube is passed and left in place for sufficient time to permit the gas forced along by the peristaltic stimulants to be expelled. Enemas are given not oftener than twice a day. Within the first 48 hours after operation we use enemas of small volume composed of 200 cc. of water and 200 cc. of glycerine. Later these enemas are useful, but enemas of larger volume, such as the soapsuds enema of 1,000 cc. with 8 cc. of turpentine, may be more effective. An enema of 240 cc. of milk and 240 cc. of molasses is particularly effective. It is well to time the giving of an enema a few minutes after the injection of the drug. If the patient is unable to expel the enema after a reasonable time, it is siphoned off with a rectal tube, for a retained enema serves only to increase the patient's discomfort.

The Levin tube should be passed and attached to suction. This is especially effective if gastric dilatation is prominent and if nausea and vomiting accompany the distention. Heat may be applied to the abdomen by means of a light or by stupes. The former method, if available, is more convenient and as effective as stupes. The intake of fluids by mouth should be reduced, and when the tympanites is marked and nausea and vomiting are present, they should be stopped temporarily. Body fluids and nourishment should be maintained by intravenous solution composed of glucose and normal saline. In the first 48 hours after operation cathartics are worse than useless. The paralyzed bowel cannot be whipped into activity. Some time

should elapse to permit it to regain tone before administering stimulants to it. On the 3rd postoperative day mild laxatives, such as milk of magnesia, may be given by mouth or through the Levin tube. When a mechanical obstruction is seriously suspected, cathartics are contraindicated. Likewise, when the condition of the large bowel is weakened by operative injury or pelvic inflammation, enemas and rectal tubes are contraindicated. Often a glycerine suppository may be substituted safely and effectively. When a certain degree of chronic distention persists for 5, 6 or more days we occasionally give a dose of castor oil. It is drastic therapy; but after it has passed through the intestinal tract, usually the patient is relieved permanently of her distention.

### WOUND INFECTION

Severe wound infection is rare in the better clinics, but in spite of the most careful supervision of sterile technic in the sterilizing and the operating rooms, occasionally fulminating wound infections occur. When the case has been a clean one, it is obvious that someone has broken sterile technic. In our experience a careful check of the method of sterilization and procedures in the operating room seldom throws any light upon the cause of the infection. In training nurses and interns, occasional breaks in technic are observed; certainly some are made which escape the eyes of the experienced members of the operating-room staff. Although in going over the procedures in retrospect it is usually impossible to discover the guilty member, nevertheless one is obligated to check the sterilization methods and the operating-room habits of the staff. The effect of the checking tends to make everyone conscientious and careful of his sterile technic.

Slight infections in low mid-line incisions occasionally occur and perhaps to some extent are unavoidable. They are particularly common in the lower end of the incision where the many hair follicles may harbor bacteria, untouched by the usual sterilizing solutions applied to the operative field. The number of such infections varies directly with the obesity of the patient. Not only is the incision in the excessive panniculus a favorite place for bacteria to multiply, but

the folds of skin, moistened by perspiration, harbor more bacteria than the drier skin of the thin individual. Minor skin infections can be reduced to a minimum by two precautions. After the skin incision has been made, the skin margins should be covered carefully with gauze or towels during the course of the operation. In addition, meticulous care in hemostasis before closure will greatly reduce the incidence of wound infection. When the operation has been unusually long, and particularly when the abdominal wall is obese, pouring ether into the wound after closure of the fascia dissolves the free fat that has been squeezed out of the tissues during the operation and also dissolves small blood clots. If hematomas in the wound are discovered postoperatively, they should be evacuated, and antibiotic therapy should be instituted. When active infection has been encountered within the abdomen and the operator feels that drainage is necessary, it is our custom to close the mid-line incision without drainage, but while the incision is still open a cigarette drain is placed through a stab wound directly over the point to be drained. Prophylactic doses of one or more of the antibiotics are valuable when wound infection is anticipated. It is surprising how often a mid-line incision heals per primam in the presence of active intra-abdominal infection, if these procedures are carried out.

In spite of all precautions and meticulous technic, abdominal wounds may become infected quickly and actively by contamination from known intra-abdominal infection and rarely in clean cases. In some instances the wound may show evidence of infection almost immediately after operation. However, in the majority of cases, the wound infection develops to a point where it becomes apparent in 5 or 6 days. Then the temperature, instead of falling to normal as it does in the average case, rises. The patient complains of not feeling up to par and has the general malaise consistent with the temperature elevation. She may complain of more than the usual discomfort in the incisional region, but often there is surprisingly little. In most instances the wound infection is discovered in a routine search for the cause of a temperature elevation. The wound has more than the usual induration and tenderness. If the in-

fection is near the surface, there is reddening of the skin and fluctuation, but frequently an infection deep in the panniculus shows nothing superficially. If there is presumptive or positive evidence of an incisional abscess, it can be opened by thrusting forceps into it through the incision. If there is insufficient evidence for serious suspicion of an abscess, the wound should be investigated again in 24 hours. Opening of the abscess usually brings the temperature down promptly, and healing is rapid. At the time of drainage a swab should be sent to the laboratory immediately for culture and sensitivity tests. If an abscess is present, or if there is considerable induration, hot compresses of normal saline are applied. The author believes that moist heat is superior to dry heat in aiding evacuation of the abscess cavity. Daily irrigations with normal saline solution, hydrogen peroxide or antibiotic solutions are of value. After drainage has been established, heat applied by electric bulbs beneath a cradle hastens healing. All such infected cases should be appropriately isolated. If there has been marked separation of the skin edges, they may be drawn together with narrow strips of sterile adhesive tape after the infection has cleared up and healthy granulation tissue is present.

In rare cases a wound infection, instead of coming to abscess formation, spreads over the abdominal wall as cellulitis. In such instances chemotherapy should be used in full dosage, as well as appropriate local measures.

#### POSTOPERATIVE WOUND DISRUPTION AND EVISCERATION

Postoperative disruption of the recently sutured wound with evisceration of the abdominal contents is a serious but, fortunately, a rare complication. It is interesting to study the incidence reported from various clinics and to compare them with our own as a means of judging one's method of closure. The largest series reported in the literature is that of Sokolov. He collected 732 cases from the clinics of Europe and America and estimated the general incidence to be from 2 to 3 per cent of laparotomies. Melency and Howes estimated that it occurred in from 1 to 2 per cent of the abdominal wounds in the Presbyterian Hospital of New York.

Bettman and Lichtenstein found that it occurred 32 times in 7,500 laparotomies, excluding McBurney incisions, an incidence of 0.43 per cent. Schmitz and Beaton studied a series of 10,725 laparotomies at the Cook County Hospital and found 16 eviscerations, an incidence of 0.15 per cent. A recent study of 3,179 pelvic laparotomies done on the obstetric and gynecologic service at the Chicago Lying-In Hospital showed an incidence of 0.47 per cent. In a 10-year period we performed 5,955 laparotomies on the gynecologic service at the Johns Hopkins Hospital and have had 6 eviscerations, an incidence of 0.1 per cent.

It is to be expected that the incidence of eviscerations should be lower on a gynecologic service than on a general surgical service, and such apparently is the case. The reasons for this are twofold. The incidence is about twice as great in men as in women, and most observers believe that the incidence is greater in the upper abdomen than in the lower; it is greatest in stomach operations. Many authors believe that the presence of carcinoma greatly increases the danger of wound disruption.

On studying the literature, apparently there is no uniformity of opinion regarding the cause of wound disruption. Obesity, infection, failure to use tension sutures, catgut allergy, vitamin C deficiency, excessive coughing, distention, excessive vomiting and the passage of the stomach tube—all have been considered causative factors by different students of the subject. Other authors have concluded that few or none of these are of any importance. Our own experience is given here for what it is worth. During the 10-year period covered in our study, we did 2,694 laparotomies on white women and 3,261 on Negro women. All of the eviscerations occurred in the Negro patients. Can any conclusions be drawn from this fact? There is much more obesity among the colored women than among the white. We are inclined to feel that this is a factor; several of the eviscerations occurred in excessively obese women. Pelvic infections are more common among the colored women, and infected incisions are correspondingly more frequent. An infected incision cannot be healed as strongly at the time the wound is

most susceptible to disruption. In our series the average day of evisceration was the 10th, but in general the greatest incidence is on the 8th day. Large tumors are more common in the colored ward; hence, the incisions average much longer. This would seem to increase the possibility of disruption. The average hemoglobin is lower among colored women. This may be explained to a certain degree on the greater incidence of bleeding fibroids, but this is not the entire explanation. In those who have not bled, the average hemoglobin is still lower among colored women. Possibly this can be explained on the basis of vitamin deficiencies in their diet. Wolfer has suggested that vitamin C deficiency plays an important role in wound healing, and one wonders whether or not this could be a factor in the greater incidence of evisceration in the colored race. The question of allergy to catgut has been suggested as an explanation in certain cases in which the catgut appears to have been completely absorbed in an amazingly short time. We have seen such a phenomenon occur, but do not feel that on the evidence at hand one is justified in arriving at the conclusion that this is due to allergy.

It appears to be the opinion of most authors that the omission of tension sutures is not a factor in predisposing to wound disruption. We are not convinced of this. We have almost routinely used tension sutures on our service and have maintained a very low incidence of wound disruption (0.1%). This happens to be lower than any figure that we have found in the literature; hence, we are not inclined to change our routine of closure. Most authors believe that distention and excessive vomiting and coughing may, on occasion, be responsible for evisceration. In such cases, it seems that the extra support of tension sutures may help to relieve the strain on the suture line and be of special value when these symptoms continue for as much as a week when the catgut becomes considerably weakened. On more than one occasion we have seen disruption of a wound stop at the site of a tension suture, suggesting that the disruption would have been more nearly complete had the tension suture not been there.

It is obvious that early recognition and

prompt treatment greatly facilitate the chances of recovery; hence, it is important that house officers and nurses recognize the signs and symptoms suggestive of wound disruption. It is true that some eviscerations occur entirely without symptoms and are discovered at routine dressing. However, the majority present symptoms and signs which at least call for investigation. Sometimes the patient is conscious of something's "giving way." The appearance of serosanguinous fluid on the dressing always should be reported by the nurse and calls for investigation of the wound. When this occurs with the appearance of abdominal discomfort in the region of the wound, disruption should be strongly suspected. When obstructive symptoms occur with the above symptoms, the diagnosis is very probable.

The mortality rate is uniformly high in all reported series. Schmitz and Beaton report 68.7 per cent; Sokolov, 32.1 per cent in the cases in which resuturing was done and 35.5 per cent in the cases in which it was not done. Meleney and Howes report 37.5 per cent. Two of our 6 patients died, one during the course of the resuturing and the other from pulmonary embolism.

Immediate suturing is indicated. Supportive treatment should be started immediately on discovery of the condition as preparations are being made for resuturing. All 6 of the patients in our series were resutured immediately.

Ordinarily, when the evisceration is discovered, the patient is given  $\frac{1}{4}$  grain of morphia, and the skin is strapped with flamed adhesive. She is warned against coughing and is told that it will be necessary to take her to the operating room for a slight operation. Every effort is made to avoid alarming the patient. If an expert spinal anesthetist is available and the condition of the patient is not too critical, a spinal anesthetic is given. Otherwise, intravenous Pentothal Sodium is quite satisfactory. The light respiratory movements with Pentothal Sodium is advantageous in replacing the intestines into the abdomen. The skin is cleaned up with ether and alcohol, and the intestines are manipulated as little as possible to replace them into the peritoneal cavity. Culture of the wound is taken. Treatment with one

or more of the antibiotics is started and continued as long as indicated. We routinely close the abdomen with through-and-through sutures of heavy silver wire. This has been our custom for many years, and it is gratifying to note that the mortality rate is considerably lower in the literature when through-and-through closure is done than when a layer-for-layer closure is made. The silver wire sutures are put in at intervals of about an inch (Fig. 52). Care is taken not to injure the bowel. The silver-wire sutures are not twisted closed until all have been placed because lifting them upward, untied, facilitates the placing of the other sutures. A few fine silk interrupted sutures may be placed in the skin between the silver-wire sutures.

Postoperatively, intravenous fluids are given as necessary, and duodenal suction is started. If real obstructive symptoms develop, the Miller-Abbott or Cantor tube is used. Treatment with one of the broad-spectrum antibiotics is started, intravenously if necessary, and is continued as long as indicated. The silver-wire sutures are left in until healing appears to be complete, which usually requires about 3 weeks.

## PERITONITIS

### ETIOLOGY

Postoperative peritonitis may result from infection carried into the peritoneal cavity by the hands of the operator or the assistants or breathed into the wound by a member of the operating team. Infection also may be the result of improperly sterilized instruments, sutures or solutions used at the operation. Peritonitis, due to trauma, occurs in the field of operation after each surgical procedure. This is a sterile peritonitis if the asepsis has been perfect.

If organisms have been introduced at operation, the traumatized peritoneum serves as a good culture medium for their growth. If a pack or a drain has been left in the peritoneal cavity, a tract is established for the entrance of organisms. This invasion along a drainage tract is inevitable if the drain remains in for longer than 48 hours, but in most instances the tract is sealed off by coils of intestines and omentum. We rarely drain the peritoneal cavity except when a

walled-off abscess must be evacuated or when a necrotic abscess wall cannot be removed completely. Very rarely, however, a drain with free gauze at its end is required to be left in the peritoneal cavity to control the oozing of blood which is uncontrollable by other methods. It is well to remove such a drain as soon as safety permits, for the longer the drain remains in the abdomen, the greater is the opportunity for infection to travel along its course. Drains that must be kept in place for a long period of time should be removed a few centimeters at a time to permit collapse and healing of the tract. In gynecology today, however, much less gauze packing is used than formerly, for most oozing can be controlled with Oxyel and the abdomen closed without drains.

Peritonitis can also follow operation as a result of dissemination of infected material present in the pelvis. Following the conservative plan of treating salpingitis as practiced in most clinics today, this is rarely seen. In the earlier days, when operation was done for acute and subacute salpingitis, dissemination of the infection through the peritoneal cavity was more frequent. Fortunately, the gonococcus is a great adhesion former so that when pyosalpinges or tubo-ovarian abscesses are disturbed surgically in the presence of active gonococcal infection, the sigmoid, the mesosigmoid and the omentum frequently become stuck down and keep the infection from becoming generalized. Infections due to the colon bacillus, streptococcus and staphylococcus have less tendency to become walled off, and the resulting generalized peritonitis is often serious.

### SYMPTOMS

The symptomatology of postoperative peritonitis is frequently quite different from that of peritonitis occurring in the individual who has not had an operation. There is often confusion in making a correct diagnosis because the somewhat exaggerated postoperative symptoms and signs, such as persistent nausea and vomiting, distention, elevation of temperature and leukocytosis, may be very similar to those of real peritonitis. Then, too, the patient is apt to be under the influence of sedatives, and symptoms may be masked. Usually, the patient in whom peritonitis is

developing changes gradually from the normal postoperative picture to one of adynamic ileus, yet this is not always the case. At times peritonitis is ushered in with diarrhea. A disproportionate rise in the pulse rate over that anticipated from the temperature is very suggestive of peritonitis. Occasionally, within 24 hours of the operation, all the classic signs and symptoms of fulminating peritonitis develop. When fever, high leukocytosis, abdominal pain, rapid pulse, rapid and difficult respirations, a fall in blood pressure, inability to pass flatus, nausea, vomiting and anxious facies are present the diagnosis is made readily. Sometimes the abdomen is rigid, but we have been struck with the frequency of a soft abdomen in the presence of postoperative peritonitis.

#### TREATMENT

Whenever peritonitis is diagnosed or seriously suspected, vigorous treatment should be instituted. The patient is placed in Fowler's position. If the peritonitis is limited to the pelvis, this position will tend to keep it there. If it is generalized, the sitting position will aid the free pus to gravitate to the lower abdomen and cul-de-sac where it may be drained successfully. Sedatives are necessary for the pain. Morphia is advantageous, for it tends to inhibit peristalsis and retard the spread of the intraperitoneal infection. Fluids and nourishment are maintained by the intravenous administration of a mixture of glucose with normal saline solution. Fluid intake and output are recorded, and electrolyte balance is maintained. The patient should get at least 3,000 cc. of a solution of glucose and normal saline to replace insensible fluid loss and urinary output. In addition, the equivalent of the Levin tube drainage should be replaced by normal saline. Also, an average of 30 to 40 milliequivalents of potassium should be given daily. If gastrointestinal drainage is very great, the electrolytes should be increased proportionately. Food by mouth should be prohibited. Broad-spectrum antibiotics, such as penicillin, streptomycin or chloramphenicol, should be administered parenterally. Repeated transfusions of whole blood as indicated are of great value in maintaining normal blood volume for maximum body resistance. While these procedures are

being carried out, constant gastrointestinal suction is maintained through the Levin or Cantor tube. Repeatedly, gentle abdominal and pelvic examinations should be made, bearing in mind the possibility of an abscess's being walled off which might be drained through the abdomen or the posterior vaginal fornix.

#### FOREIGN BODIES IN THE PERITONEAL CAVITY

Fortunately, no one surgeon has a very extensive experience with this complication, but taken in the aggregate the objects that have been left in the abdomen are too numerous to count. On occasion, most of the metallic instruments used in surgery have been left inside the peritoneal cavity. The commonest object is the gauze sponge. To avoid the loss of a sponge in the abdomen various schemes have been devised. In many operating rooms the sponges are counted as a matter of routine. We never have practiced this but have an invariable rule that as soon as the peritoneal cavity is opened, all free sponges are removed from the operating table. This rule can be carried out much more easily in gynecology than in general surgery. The general surgeon often can use an open gauze sponge to advantage in intestinal surgery, but in pelvic surgery all necessary sponging can be done with a folded sponge in a sponge holder. Only loaded sponge holders are permitted on the operating table, the loading being done at the instrument table. Whenever an empty sponge holder is seen on the operating table, someone is made to account for the absence of the sponge. Whenever the operator or his assistant removes a sponge from a holder, as occasionally happens when a sponge is contaminated, he calls it to the attention of the nurse in charge of sponges.

The symptoms caused by an intraperitoneal foreign object are variable. If infected, there may develop signs of an intra-abdominal abscess. If uninfected, there may be no symptoms for a time or even permanently. We have removed a gauze sponge in the course of a routine hysterectomy for fibroids which was encapsulated within the omentum without any symptoms referable to it. It was left in the abdomen 15 years before. Usually

gauze or instruments eventually erode into a hollow viscus. Either the intestines or the bladder may be entered. Then infection develops; frequently, a walled-off abscess forms. When this occurs in the early convalescence, the wound usually breaks down, and a fistula is established. Of course, a flat x-ray plate of the abdomen will reveal the presence of an instrument, and frequently a gauze sponge will cast sufficient shadow to be identified. Of course, radiopaque tagged sponges are advantageous. The treatment consists of removal of the foreign object. If a fistula is present, it should be excised. If the fistula communicates with the bowel or intestine, the opening in the viscus is closed. Such an operation may be extremely difficult, since the adhesions about the fistulous tract are usually very dense. Furthermore, the fistulous tract may be formed by loops of bowel, the tearing of which may be avoided with the greatest difficulty. Patients upon whom such an operation is to be performed should be put on sulfasuxidine (12 Gm. per day) for 5 days preceding the surgery. During the 24 hours before the surgery she should be treated with adequate dosage of Neomycin.

## PULMONARY COMPLICATIONS

### ETIOLOGY

Postoperative pulmonary complications are of interest not only to the gynecologist but also to the internist who is frequently called in for aid in diagnosis and treatment. They also concern the roentgenologist, whose interpretation of the film is of greatest importance, and the bronchoscopist, whose skill in removing mucous plugs is often exceedingly valuable as a therapeutic measure. Fortunately, pulmonary complications are not as frequent following gynecologic laparotomies as after surgical operations in the upper abdomen. There appear to be two reasons for this: the patients are operated upon while in the Trendelenburg position, and there is less suppression of respiratory movement with pelvic surgery than with operations nearer the diaphragm.

It is difficult to classify pulmonary complications with accuracy, but the grouping of the various clinical types by King is con-

venient and as satisfactory as any. Exclusive of massive pulmonary embolism, he has classified pulmonary complications as bronchopneumonia, pneumonitis and massive collapse (atelectasis). The cases that run the clinical course and present the typical x-ray picture of true bronchopneumonia are relatively few, but most of the fatal cases are included in this group. There is another relatively small group of cases which present the clinical picture and x-ray findings of massive collapse. These cases are due to occlusion of the large bronchus by exudate and get well quickly when the plug is expelled or removed. The third group is numerically larger, but the cases are less clear-cut than those of either of the other two groups. They are not pneumonia in the usual medical sense, since they run a shorter and less toxic course. Whipple has called this group pneumonitis, indicating that the alveolar exudate is caused by relatively less-virulent pneumococci. Some clinicians consider these cases to be the result of multiple small emboli. Attractive as this theory is, it cannot be proved. Certainly this type of pulmonary complication occurs much earlier in the postoperative course than the typical proved cases of massive pulmonary embolism. Another group of clinicians regards the primary cause of this type of pneumonitis as mucous plugs in the lesser bronchi, causing small areas of atelectasis and resultant pneumonitis.

The etiologic factors concerned in respiratory complications have been studied by Beckman, Fenwick and Sullivan who analyzed them following 2,000 operations for inguinal hernia. Their results follow the general pattern of those found in the literature. There was an incidence of 7.3 per cent of respiratory complications following general inhalation anesthesia; 9.1 per cent following spinal, and 10.3 per cent following local anesthesia. King found that pneumonia, pneumonitis or massive collapse occurred in 14 per cent of laparotomies and herniorrhaphies. The incidence with inhalation anesthesia was 12.7 per cent; with spinal anesthesia 16.6 per cent; and with local anesthesia 18.4 per cent. In interpreting these statistics, it should be remembered that the patients given local anesthesia were, on the whole, in much poorer condition. However, these statistics indicate



that spinal and local anesthesia are not a safeguard against pulmonary complications. Statistics also show that the incidence of pulmonary complications is in direct proportion to the duration of the anesthetic.

The pathologic physiology associated with those cases in which atelectasis exists is due to plugging of a bronchus or bronchi with mucus. Air is thus prohibited from entering the portion of the lung aerated through them, and soon the trapped air is absorbed from the lobe or lobules. It is probable that the plugged bronchus or bronchi and others go into spasm, which further increases the obstruction. If a large area of lung is involved, a negative pressure is created in the affected half of the chest, and the heart and the mediastinal structures are retracted toward the involved side. The diaphragm is pulled upward, and the intercostal spaces are narrowed. If the bronchus is permitted to remain occluded, the affected lung area becomes invaded with organisms, and an area of pneumonitis develops.

### SYMPTOMS

Most pulmonary complications of the types under consideration become manifest within 2 or 3 days after the operation, but occasionally they occur after many days. The nature and the severity of the symptoms are most variable. Massive atelectasis where a whole lobe or a whole lung is involved usually produces sudden alarming symptoms. There is a sudden rise in the temperature, the pulse and the respiratory rate. The patient attempts to cough and becomes dyspneic and cyanotic. With bronchopneumonia or pneumonitis the onset may be fairly acute, but usually respiratory symptoms develop much more gradually.

The physical signs vary as greatly as do the pathologic processes. Distinguishing between atelectasis due to plugging of the lesser bronchi and true bronchopneumonia may be impossible. Indeed, it is undoubtedly true that the primary lesion in many cases of bronchopneumonia is atelectasis. X-ray evidence is often unconvincing in attempting to distinguish the two processes. With massive collapse the physical signs and the x-ray picture are identified more easily. There is diminished expansion on the affected side;

the trachea and the cardiac apex are displaced toward the atelectatic side. The collapsed lung is dull or flat to percussion, and breath sounds and rales are absent. After the mucous plug is expelled, there may be bronchial breathing due to areas of pneumonic consolidation about the bronchi. The x-ray showing the displaced organs and the shadow cast by the collapsed lung is a typical picture and confirmation of the rather characteristic physical signs.

### TREATMENT

Prevention is of the utmost importance in pulmonary complications, and much can be done which is most effective. Elective surgery should be avoided if there is any degree of upper respiratory infection. If acute or chronic bronchitis or tracheitis is present, an active attempt should be made to clear up the condition. Frequent inhalations of benzoin or menthol mixtures are most effective. The Trendelenburg position during the operation permits secretions to run out of the trachea or be aspirated by the anesthetist and this is without doubt a factor in the decreased incidence of these complications in gynecologic laparotomies. Since this position is used routinely in most gynecologic laparotomies, it is unnecessary to call this fact to the attention of gynecologists, but it is doubtful whether most gynecologists appreciate the value of the Trendelenburg position during the immediate postoperative period when bronchial secretions are often excessive. Some students of these lung conditions advocate the avoidance of atropine preoperatively, believing that it dries the bronchial secretions and makes them more tenacious. We have used atropine routinely for years and hold a contrary view. The reduction in secretions during the operation permits better aeration of the lungs and in our opinion has contributed to our very low incidence of pulmonary complications. The use of 5 per cent carbon dioxide during the course of the anesthetic and especially at the end of the operation to ensure complete expansion of the lungs is useful. Patients should be encouraged to breathe deeply after operation, and when respirations are shallow, they may be increased greatly in depth by using a paper bag for re-breathing.

The active treatment of postoperative pulmonary complications varies with the type of lesion present. If the picture is one of bronchopneumonia or pneumonitis, chemotherapy should be used as in ordinary pneumonia. If the patient is anoxicemic, oxygen should be supplied. When the picture is that of a massive plugging of a bronchus by a mucous plug, the bronchial obstruction should be relieved as soon as possible and by the best means available. Coughing should be encouraged and, as the patient coughs, the affected side of the chest may be compressed by the physician's hands. The abdomen should be splinted tightly with a Scultetus binder during this procedure. Morphine should be avoided to prevent suppression of the cough reflex unless one is in constant attendance with the patient to encourage or stimulate coughing. If a competent bronchoscopist is not available, intratracheal catheter suction may be used. Sometimes the plug can be removed successfully by this procedure, but even at best it is a blind one, and bronchoscopy can be done with much more certain relief. In competent hands it is safe and rapid. It is well not to defer bronchoscopy for a long time so that the plug may be removed before pneumonia develops.

#### PHLEBOTHROMBOSIS AND THROMBOPHLEBITIS

The intravascular clotting of blood constitutes one of the more serious postoperative complications. A distinction is made between phlebothrombosis and thrombophlebitis because they differ in their pathology and clinical manifestations. Phlebothrombosis is a partial or complete venous occlusion by an intravascular clot which is unassociated with inflammation. Thrombophlebitis is partial or complete venous occlusion by an intravascular clot which is associated with and dependent on inflammation of the vein wall. Both may occur as medical conditions, especially with myocardial disease and with a serious febrile illness such as typhoid fever. However, many cases of intravascular clotting of blood occur as complications of abdominal operations. In a series of 11,435 abdominal operative cases collected in the literature by Ochsner and De Bakey, 3.8 per cent were complicated by thrombosis. The

highest incidence follows gynecologic laparotomies, the above authors finding an incidence in the literature varying between 1.25 per cent and 12.5 per cent. The incidence at the Mayo Clinic was 1.6 per cent of all laparotomies and 2.7 per cent of all pelvic laparotomies.

#### PATHOLOGY

The pathology of intravascular clotting deserves consideration, for an understanding of it is necessary to intelligent prophylaxis and treatment. Homans has divided the cases into three categories which are familiar to all with extensive surgical experience. The first group, which has been described as phlegmasia alba dolens, takes the form of a thrombosis of the deep veins of the limb. The clotting, in most instances, begins in the iliac veins and extends for a variable distance into the femoral vein. This group represents a true thrombophlebitis and is associated with diffuse swelling of the lower extremity and fever. The second group represents a thrombosis of the superficial veins of the extremity, with palpable thrombus formation in the great saphenous vein. It may occur as an independent process or as an extension of the phlebitic process from the femoral. It may be a true thrombophlebitis with inflammation of the vein wall and perivascular tissues or, less commonly, it may be a phlebothrombosis. There is less generalized edema of the lower extremity with this type than when the deep veins are thrombosed, but recurrences of the phlebitic process are more common. The third group represents thrombosis in pre-existing varicose veins. There may be swelling and reddening about these superficial varicose veins, but often the process is a pure phlebothrombosis with little evidence of inflammation.

In phlebothrombosis there is little change in the vascular wall and perivenous tissues. Microscopically, there may be some swelling of the intima with desquamation of the endothelial cells. In thrombophlebitis there are changes in the vein wall itself and in the perivenous tissue. The vein wall is hyperemic; there is cellular and serous exudation and some actual necrosis of the wall, especially the intima. Leukocytes adhere to the wall and migrate into it. The thrombi in

phlebothrombosis are usually of the red variety, appearing like extravascular blood clots. The thrombi occurring in thrombophlebitis are usually of the white variety, consisting chiefly of leukocytes, platelets and fibrin. The white thrombi are more firmly attached to the inflamed vessel wall and are less apt to be dislodged. Thrombi are not uncommonly of a mixed variety; red thrombi often occur in the area of blood stagnation near the white thrombus.

### ETIOLOGIC FACTORS

Although much remains to be known concerning the cause of intravascular clotting of blood, certain factors are recognized which tend to cause phlebothrombosis and thrombophlebitis.

Injury to the vessel wall is conducive to intravascular clotting. This is borne out by the fact that operations in the neighborhood of the pelvic veins have the highest incidence of thrombosis in the pelvic and the femoral veins. Infectious processes, involving the vessel wall, and arteriosclerotic changes in the wall also increase the incidence of thrombosis. Injury to the vessel wall from infection may be from the blood within the vein or from the perivenous tissue.

Changes in the composition of the blood commonly occurring after operations and delivery favor the coagulation of the blood. The blood platelets increase in number following major operations and are at their peak usually between the 8th and the 11th days. There is an increase in the leukocytes, an increase in fibrinogen, a change in the albumin-globulin ratio in favor of globulin and an increase in blood viscosity. These factors tend to cause platelets to agglutinate and facilitate coagulation of the blood.

The fact that intravenous clotting occurs most frequently in bedridden patients, both medical and surgical, suggests that slowing of the blood stream plays an important role in the etiology. The occurrence of clotting in pre-existing varicose veins with sluggish circulation also points to the idea that a slowed circulation favors thrombosis. The immobility of the lower extremities after operation, which in any case have a less-active circulation than the upper extremities, favors the greater incidence in the lower limbs. It is gen-

erally known that thrombosis is more common in the left lower limb than the right. For example, Hampton and Wharton found thromboses to occur in the left lower extremity in 66 per cent of the cases at the Johns Hopkins Hospital, whereas only 24 per cent occurred in the right; 9 per cent were bilateral. At the Mayo Clinic, Brown found 65 per cent on the left, 16 per cent on the right and 20 per cent bilateral. A possible explanation of this lies in the fact that the left iliac vein is crossed and compressed by the iliac, the hypogastric and the middle sacral arteries. Shallow postoperative respirations lessen the intrathoracic changes in pressure and thus reduce the aspiration of blood into the thoracic vena cava from the abdominal vena cava and lower veins. Abdominal distention also has a tendency to compress the intra-abdominal veins and reduce the back flow of venous blood from the lower extremities. De Takats explains the effect of slowed circulation upon thrombus formation as follows:

In the normally circulating blood, the axial stream consists of corpuscular elements, whereas the marginal stream is chiefly plasma with an occasional leukocyte. The slower the circulation becomes, the narrower becomes the axial stream, with the leukocytes, and later the platelets, assuming a marginal position. This course of events alone, however, will not produce an agglutination of platelets or a fixation of these platelets to the vessel wall, unless other factors are in operation. Thus, complete stagnation of blood between two venous ligatures applied with minimal injury to the intima does not necessarily produce thrombosis.

### SYMPTOMS AND SIGNS

Postoperative venous thromboses occur in three forms which are familiar to all gynecologists. The first is the picture resulting from thrombosis of the deep veins of the lower extremity. In most instances these thromboses probably begin in the pelvic veins and extend through the iliac veins down into the femoral. Such cases represent true thrombophlebitis and are ushered in by fever, sometimes chills and pain in the calf, the popliteal space and the groin. The leg begins to swell very promptly, and there develops within a short time the typical picture of phlegmasia alba dolens. In the more severe cases the entire lower extremity becomes markedly

swollen within 2 or 3 days. It may be cyanotic for a day or two but soon becomes white and edematous. Homan aptly asks the question, "Why the absence of blueness?" From the experiments of Reichert it would seem that phlegmasia alba dolens represents a lymphatic obstruction due to an inclusion of the trunk lymphatics of the limb in the inflammatory process and that simple stoppage of the venous flow by division of a vein does not produce that picture. The explanation of the absence of persistent cyanosis probably lies in the presence of numerous anastomotic venous channels among the deep veins of the leg. A tender cord may be palpable in the femoral region. In the severe and persistent cases of deep vessel thrombophlebitis, chronic edema remains, due to involvement of the lymphatics in scar tissue.

The second type of spontaneous thrombosis occurs in the normal great and small saphenous veins. There is reddening of the perivenous tissues and considerable localized induration, redness and tenderness. The perivenous lymphatics become obstructed, and edema develops. This edema is not nearly as generalized as is encountered with the deep type of iliac-femoral phlebitis, but recurrences of saphenous phlebitis are common, and chronic edema frequently develops. The ultimate condition of the leg is often worse with superficial phlebitis than with the deep variety.

The third type of venous thrombosis is that associated with pre-existing varicose veins. This type is less commonly encountered postoperatively but is seen occasionally. Trauma and infection play a lesser role in this type, and the process is more often of a phlebothrombotic nature than one of thrombophlebitis. In thromboses of this type there is usually little, if any, edema or induration.

#### TREATMENT

In the diagnosis of these types of venous obstruction an unequivocal Homan's sign is pathognomonic. Comparative leg measurements are often helpful.

The treatment of thrombophlebitis and phlebothrombosis divides itself into three categories: prophylactic, conservative and operative.

Prophylaxis at the operating table consists of avoiding undue trauma in order to minimize injury to pelvic veins. On return to the ward and during early convalescence, the patient should be kept well hydrated to reduce the viscosity of the blood. Deep breathing is encouraged. She should be asked to take several deep breaths each hour, and if breathing is very shallow in the hours immediately following operations, respirations may be stimulated with carbon dioxide. Fowler's position is avoided unless seriously indicated, for the pressure on the femoral veins by constant flexion of the thigh and the pressure on the popliteal vessels tend to slow venous return. The prevention of abdominal distention is helpful in augmenting the return of venous blood to the thoracic vena cava. Some surgeons believe that immobilization of the abdominal wall by extensive strapping with adhesive tape is conducive to retarding venous return. We do not subscribe to this point of view, since the splinting which the patient receives from the liberal use of adhesive tape adds greatly to her comfort and permits her to move about in bed more freely. We believe that this greater movement adds more to the prevention of thrombosis than is lost by splinting the abdomen. The patient should be encouraged to move the lower extremities. In some clinics the beds are fitted with bicycle pedals where they can be worked easily by the recumbent patients, and they are made to pedal at intervals during the day. There is little doubt that this aids circulation in the lower extremities, but it is a somewhat awkward arrangement. We believe that the same purpose can be accomplished by following the suggestion of Cullen, who placed a small pillow at the foot of the bed and encouraged the patient to pommel it frequently with her feet.

Within the past several years medical prophylaxis has been carried out by the use of heparin and Dicumarol.

Heparin, which is the body's own anticoagulant, was discovered by Jay McLean in 1916. It is produced by the mast cells of the connective tissue and is found chiefly in the neighborhood of the smaller blood vessels. Its chemical nature is known, being a mucoitin polysulfuric acid with not less than 40 per cent of sulfuric acid. It possesses an

exceedingly high negative electrical charge which enables it to react with some of the components of the coagulation system and to prevent coagulation. Crafoord and Jorpes have reported 325 general surgical cases treated prophylactically with heparin without any recognizable symptoms of thrombosis. In a control series of 1,111 cases, thrombophlebitis occurred in 9 per cent. In a group of 88 treated gynecologic cases there were no instances of thrombophlebitis, whereas it occurred in 4 per cent of a control series. The administration of heparin is given with intravenous saline solution, beginning 4 hours after operation and being continued for a period of from 5 to 10 days. The dosage administered by Crafoord and Jorpes was 50 mg. per dose 3 times a day and 100 mg. at bedtime. Heparin is expensive, and its administration is tedious. This has been overcome to some degree in recent years by the administration of depo-heparin sodium, subcutaneously or intramuscularly. The initial dose is 400 mg. (2 ml.) followed by 200 mg. (1 ml.) every 24 hours, depending upon the clotting time. Obviously, it cannot be used routinely after all pelvic laparotomies. However, general experience coincides with that of Crafoord and Jorpes, and it may be used profitably in those cases in which there appears to be more than the usual risk of intravenous clotting. When there is evidence that there is an excessive anticoagulant effect from heparin, protamine sulfate may be used to counteract its action. The 1 per cent solution is diluted with an electrolyte solution and administered slowly by vein over a period of 3 minutes. The total dose should be the same, mg. for mg., as the quantity of heparin which has been administered in the previous 3 or 4 hours. However, the amount of protamine sulfate given at one time should not exceed 50 mg.

More recently, the compound known as Dicumarol has been used to prevent thrombosis. It is found in spoiled clover and is known to produce hemorrhagic disease in cattle. It has been isolated and synthesized by Link and his co-workers at the University of Wisconsin. The drug acts by diminishing the effective prothrombin concentration in the blood. Its effect on blood coagulability is variable, and its action is prolonged after

discontinuation of administration. Vitamin K is ineffective in restoring the prothrombin and coagulation time to normal. Davidson and MacDonald have concluded that these properties make it a poor substitute for heparin and that great caution must be used in its administration. On the other hand, the experience with the drug at the Mayo Clinic indicates that the carefully controlled and individualized administration of Dicumarol by mouth is effective in preventing postoperative venous thrombosis and pulmonary embolism. Barker concludes that the drug has no effect on a thrombus or embolism that has already occurred. *He also concludes that there is slight risk of bleeding in cases in which Dicumarol is administered but, if it does occur, it can be controlled by transfusing freshly drawn citrated blood.* Also, if the prothrombin activity falls to less than 15 per cent, Hykinone (50 to 100 mg.) should be administered subcutaneously to bring the prothrombin back to a therapeutic level. Barker bases his conclusions on the experience at the Mayo Clinic with 624 surgical patients. Among these patients were 259 women on whom abdominal hysterectomy had been done. The expected incidence of thrombosis and embolism in this group of hysterectomies is in the neighborhood of 4 per cent. No instances of thrombosis or embolism occurred in the treated women.

Barker describes the method of administration of Dicumarol at the Mayo Clinic as follows:

In the cases in which pulmonary embolism or thrombophlebitis had developed, 300 mg. were given as soon as the diagnosis was made. A single dose of 200 mg. was given on the following day and on each successive day that the prothrombin time was less than thirty-five seconds. No Dicumarol was given on days when the prothrombin time was thirty-five seconds or more. Occasionally exceptions were made as follows: If the prothrombin time was rising rapidly no Dicumarol was given even though the prothrombin time had not quite reached thirty-five seconds, and if the prothrombin time was falling rapidly, a dose was given the day when it was still slightly greater than thirty-five seconds. In cases in which the patients were very sensitive to the drug, doses of 100 mg. occasionally were used and in cases in which the patients were very resistant to the drug,

doses of 300 mg. occasionally were used. If the drug was administered purely for prophylactic purposes, administration was begun on the third postoperative day. The prothrombin time was kept elevated until the patient became ambulatory and then was allowed to return to normal. In some cases it was kept elevated for more than two months without evidence of untoward effect on the patient. It must be emphasized that the effect of administration of dicumarol is not immediate. After the administration is begun a period of from twenty-four to seventy-two hours, occasionally longer, elapses before the prothrombin time exceeds thirty-five seconds. Also, the effect persists for from two to ten days after administration of the drug is discontinued. If an immediate anticoagulant effect is desired, it is advisable to begin administration of heparin and Dicumarol at the same time. Since heparin does not affect the prothrombin time this can be used as an index of the effect of dicumarol alone and the administration of heparin can be discontinued as soon as the prothrombin time reaches thirty-five seconds.\*

Barker lists as absolute contraindications to Dicumarol (1) subacute bacterial endocarditis, (2) renal insufficiency, (3) puerpera, (4) blood dyscrasias and (5) existing prothrombin deficiency such as might occur in hepatic disease associated with jaundice and malnutrition. Relative contraindications are the existence of ulcerative lesions that might bleed, the necessity of another surgical operation within the next 2 weeks and vomiting due to gastric or intestinal obstruction. These contraindications also apply to heparin.

Wise *et al.* carried on an extensive study in prophylactic Dicumarol therapy over a period of 4 years at the Mercy Hospital in Baltimore. Treatment was given to 3,304 patients, consisting of hernioplasties, cholecystectomies, hysterectomies and other gynecologic operations, appendectomies, genitourinary operations and various types of colonic operative procedures. As controls a series of 2,030 similar cases were untreated, consisting of cases of previous years and cases of surgeons on the staff who preferred not to have their patients treated. Dicumarol (200 mg.) was given on the 2nd postoperative day, and subsequent doses were given

in sufficient quantity to maintain a prothrombin activity level of not under 40 per cent of normal. In the treated group there was an incidence of 0.12 per cent of thrombo-embolic complications in contrast with 1 per cent in the untreated group. In the treated group there was 0.03 per cent of deaths from pulmonary embolism, whereas in the untreated group there was death in 0.2 per cent. This study was on a sufficiently large number of patients to be significant, and the results seems to indicate clearly that Dicumarol is of value in preventing postoperative thrombo-embolic complications.

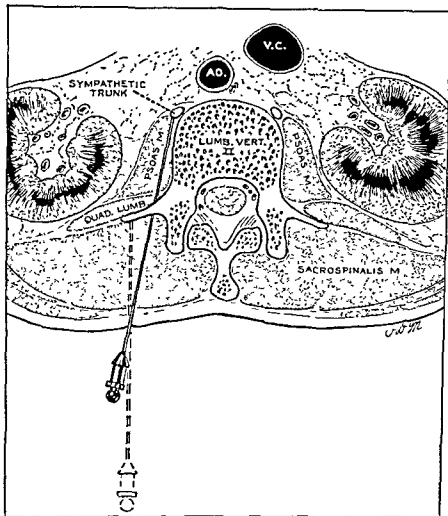
After weighing the evidence for and against Dicumarol treatment, we have not used it routinely after gynecologic operations but have reserved it for cases in which we believe that there is a greater-than-average chance of phlebitis or embolism. In this group are patients who have a history of previous phlebitis and/or embolism and patients who, because of varicose veins, heart disease, obesity or unavoidable trauma at the time of operation, are considered likely candidates for intravenous clotting.

Conservative treatment of active thrombophlebitis consists of measures to make the patient comfortable, to combat the infection and to reduce the edema. The lower extremity is elevated to about 30° and is supported by pillows, making an even distribution of weight. Wrapping the limb in cotton often gives the patient much comfort. A cradle heated with electric bulbs keeps the weight of the blankets off the leg and relieves discomfort. Hot fomentations to the extremity eases the pain and aids the collateral circulation. Sedation at the onset is usually necessary, and since the pain may be very acute, rather strong sedation must be used at first; at a later time mild ones will suffice. Laxatives should be given, and enemas avoided. Student nurses must be warned not to massage the leg at the patient's request. Indeed, they should be instructed never to rub the extremity of any postoperative patient who complains of pain, bearing in mind constantly the possibility of thrombosis even when no definite signs are present. Antibiotic therapy should be instituted immediately.

Injection of the sympathetic ganglia with

\* Barker, N. W.: The use of Dicumarol in surgery. *Minnesota Med.* 27:104, 105, 1914.

FIG. 54. Technic of lumbar sympathetic block.



a local anesthetic, as advocated by Leriche and Kunlin, is probably the most important measure than can be taken to shorten the course of the disease. Ochsner and De Bakey report excellent results with this procedure and believe from their clinical and experimental investigations that many of the symptoms and signs are due to vasospasm of the arterial and the venous systems. They believe that the vasoconstricting impulses originate in the thrombophlebitic segment, and sympathetic block breaks the reflexes mediated through the sympathetics. These authors report prompt and permanent relief of pain in all instances and a return to normal temperature within a few days to a week. In more than half of their cases the edema subsided completely within 8 days and in the remaining cases within 12 days.

Figure 54, illustrating the technic of lumbar sympathetic block, shows a cross section through the second lumbar vertebra. A needle

is inserted vertically until the transverse process of the vertebra is reached. This is represented by the dotted line. The direction of the needle is changed slightly and inserted  $2\frac{1}{2}$  fingers' breadth beyond the transverse process so that its point lies near the anterolateral surface of the body of the vertebra where the sympathetic chain lies. Fifteen ml. of 1 per cent procaine hydrochloride is then injected, and the needle is withdrawn.

Lee, Macht and Pierpont have improved greatly on procaine injections by the use of bromsalizol. Using 10 ml. of a 4 per cent solution of this substance in peanut oil, they have greatly increased the time of effectiveness of sympathetic nerve block. This has proved to be very beneficial in the treatment of acute thrombophlebitis where only one injection is sufficient in contrast with the repeated injections often necessary when procaine alone is used. The effect of the block lasts from 3 to 8 days. These authors use

bromsalizol in combination with procaine in order to get the almost immediate effect of the procaine and the lasting effect of the bromsalizol. They use the usual technic of paravertebral block. Usually, the injection of the drug in two, and rarely in three, spaces is necessary and in many instances only one injection is required. Occasionally, a second injection must be made several days after the first when symptoms return.

The patient with acute thrombophlebitis should be kept in bed for a week after the symptoms of pain and fever have subsided. When she gets up, the foot should be kept elevated, and she should not be permitted to walk until all swelling has disappeared. Even then, it is the rule for some edema to reappear with activity. Activity should be greatly restricted as long as swelling recurs, and when the patient rests she should keep her foot elevated. Bandaging of the leg with an elastic bandage, when the patient is up, keeps down the swelling. Later, when swelling lessens, an elastic stocking may be used as long as necessary. However, the use of paravertebral block with bromsalizol has greatly reduced the persistent edema and the necessity for the use of bandaging and elastic stockings.

**Operative Treatment.** The surgical treatment of acute iliac-femoral thrombophlebitis is concerned chiefly with its relation to pulmonary embolism, and consideration will be given to the subject in the section of this volume devoted to embolism. Homans ligates much more readily when there is a superficial phlebitis. He advocates ligation of the great saphenous vein above a septic thrombosis and even excision of much of the thrombosed vein, provided that it is not complicated by a streptococcal cellulitis. In the case of thrombosed superficial varicose veins, Homans advocates surgical removal as soon as the local inflammatory reaction has subsided to such a degree that it would seem unlikely to be spread by surgery. By combining chemotherapy with surgery, there is less danger of this than formerly. The late complications of chronic edema and ulcerations can best be treated surgically by excision of the damaged tissues with the intent of giving the remaining tissues new connections with the lymphatics beneath the muscular aponeurosis.

## PULMONARY EMBOLISM

Postoperative pulmonary embolism is one of the major tragedies of pelvic surgery. Barker reported 5.8 per cent of all postoperative deaths at the Mayo Clinic to be due to pulmonary embolism. Davis reported fatal pulmonary embolism as occurring in 3 out of each 1,000 persons operated upon. In the years of 1940 and 1941 there were 2 fatal pulmonary embolisms on the gynecologic service at the Johns Hopkins Hospital in a consecutive series of 1,000 hysterectomies. Welch and Faxon, studying the relation of embolism to thrombophlebitis, found that 1 out of 25 patients with clinical phlebitis died of pulmonary embolism, but 1 out of 3 patients with phlebitis developed an infarct. The thrombi which result in fatal embolisms mostly originate in iliac or femoral veins. Prettin found that 91 of 144 fatal emboli originated in the iliac and/or the femoral veins. Often it has been said that victims of pulmonary embolism either die promptly or get well. A careful survey by de Takats of patients with pulmonary embolism shows that this is not true. In his series, 8.5 per cent died in less than 10 minutes; 60 per cent lived more than an hour; and 34 per cent lived from one to several days. These data are of much importance for they indicate that there is time for active treatment in many cases. De Takats also found that if a patient survives one embolism he has a 40 per cent chance of surviving another.

Death in the majority of cases is due to failure of the right heart, resulting from plugging the main trunk or one of the main branches of the pulmonary artery. In such cases death occurs within a few minutes. However, there is a substantial minority of deaths due to pulmonary embolism in which autopsy shows a patent main pulmonary artery, and in some of these only a small branch is obstructed. This suggests that something else than mechanical plugging of the pulmonary circulation may be the cause of death. Bronchial obstruction with blood and mucus in the region of the obstructed pulmonary artery is common, with resulting atelectasis and, experimentally, it has been shown that bronchial spasm may be a factor. Also it has been shown that recurrent pul-



monary embolism may result in myocardial infarction. In 37 cases of acute myocardial infarction not due to coronary thrombosis reported by Friedberg and Horn there were 12 instances of pulmonary embolism. These authors believe that coronary insufficiency may result from the shock of pulmonary embolism, especially if there is repeated embolization and also adequate duration of life after the embolism.

### SYMPTOMS

Pulmonary embolism is one of the most dramatic and tragic accidents that occur in surgery.

The presence of an obvious thrombophlebitis or of an unexplained fever may warn of the possibility of embolism, but often the patient will have had a totally uneventful convalescence of from 1 to 3 weeks when the embolism occurs with the suddenness of lightning. Since phlebothrombosis, without fever, is the type of intravenous clot which most often becomes dislodged and results in embolism, it is understandable that often there are no premonitory symptoms or signs. Frequently, physical effort, such as occurs with getting out of bed, a bowel movement or an enema, appears to be the precipitating factor. Suddenly, the patient has an excruciating pain in the chest, she becomes cyanotic, respirations become shallow and rapid, the pulse rapid and feeble, there is a sudden fall in blood pressure, beads of perspiration appear on the face, and she lapses into unconsciousness. Death may occur within a few minutes or she may live for several minutes or hours. If she lives for an hour, her chances for recovery are rather good, but it is possible for the patient to linger for days and eventually die of the embolism. With massive embolism the differential diagnosis usually lies between that condition and coronary occlusion. If the patient lives long enough to obtain an electrocardiogram, it may help in the differentiation. McGinn and White and Barnes have independently described the electrocardiographic changes indicative of pulmonary embolism.

Small nonfatal emboli give rise to sudden chest pain, followed by the spitting up of blood, an elevation of temperature for several days. A friction rub may make its appearance

within a day or two after the embolism, and a patch of pneumonic consolidation may be evident on physical examination. Roentgenograms may confirm the presence of infarction, but small infarcts are not always detectable.

### TREATMENT

Since phlebothrombosis or thrombophlebitis, recognized or not, precedes embolism, the various procedures mentioned above to prevent intravenous clotting of blood apply equally in the prophylaxis against embolism. Patients of advanced age and with varicose veins are predisposed to thrombosis and embolism, and this should be taken into account when considering surgery on these women of poorer risk. In the group of patients with clinical phlebitis, the question of interrupting the deep veins of the leg to prevent infarction has been studied by Homans, and under his leadership the Boston surgeons have contributed most to our knowledge of the subject. Allen, Linton and Donaldson reported on 202 cases of phlebitis of the veins of the lower extremity at the Massachusetts General Hospital, in which the femoral vein or veins were interrupted. In 41 per cent of the cases, chest pain was the first symptom indicating the probability of an embolism, and in 59 per cent leg signs appeared first. It is their belief that the diagnosis of thrombosis should be followed by venous interruption, if possible, before infarction takes place. It is also obvious from their report that ligation, and in many cases bilateral ligation, should be done on the appearance of pulmonary symptoms without leg signs. They have used phlebography, but have relied on the test less and less, since they often have found clinical evidence of thrombosis and a negative phlebogram. Furthermore, the ideal time to ligate the femoral vein is when the thrombosis is in the lower leg, and in these cases phlebography is difficult to interpret. No deaths could be attributed to the surgery of femoral ligation in their 202 cases. There were some infarcts as might be expected after ligation, and there were 2 deaths after the patients left the hospital. One of these may have been due to heart failure or an infarct from the uninterrupted opposite vein. The other patient was examined postmortem and

found to have died from a fatal embolism arising in the right auricle. Postoperative edema was the only sequel of any importance following femoral ligation, and this was transient and less serious than occurs following spontaneous recovery from thrombophlebitis.

Allen, Linton and Donaldson describe the operative technic of femoral vein interruption as follows:

The operation of femoral vein interruption as carried out in our clinic is as follows: The patient is operated upon with a slight elevation of the trunk to insure positive venous pressure from above. Novocain infiltration anesthesia is used. The incision is guided by the pulsation of the femoral artery in the groin and extends distally three inches in the direction of the vein. We believe this allows a better retraction of the lymphatics and a minimal division of them—this offsets the advantage of an oblique incision making for a fine scar. The femoral sheath of the vascular bundle is divided longitudinally and the artery retracted laterally. The vein is exposed over a distance of two inches in the center of the vertical skin incision. This brings into view the common, superficial, and deep femoral veins, which are freed sufficiently to allow a ligature to be placed under them. These ligatures are left untied and used to control bleeding after the vein is incised. If the common femoral appears thrombosed, it is opened; if it appears uninvolved, the superficial femoral is opened. The incision in the vein is made transversely and through only the anterior half. Thrombi extrude through the incision and are withdrawn from the upper segment first. Suction, carefully applied, through an angulated glass drinking tube, which is inserted through the vein incision into the iliac, frequently makes it possible to clear the proximal segments sufficiently to allow free bleeding. After this is accomplished, the lower segment is cleared of thrombus by the same method. The introduction of the aspirating cannula proximally has never dislodged a thrombus. The previously placed ligatures are then tied and the vein completely divided. Transfixion sutures distal to the ligatures are then used. The wound is washed out with salt solution and closed without drainage.

The entire procedure requires about 30 minutes. In the inflammatory veins, the patient feels slight discomfort during the manipulation of the vein. Patients are allowed out of bed as soon as they become afebrile or their general condition permits. This is often on the day following

the removal of a bland thrombus. We have rarely been troubled with a short period of lymph drainage through the wound.\*

Collins has recommended vena cava ligations for femoral and suspected pelvic thrombophlebitis. He has shown that ligation of the vena cava is compatible with life and often little or no swelling of the lower extremities. However, we are not convinced of the necessity of this operation on all of Collin's indications. Nevertheless, with firm evidence of femoral phlebitis or pulmonary embolism, the procedure may be indicated.

In case of an attack of pulmonary embolism, the patient should be given  $\frac{1}{2}$  grain (0.032 Gm.) of papaverine hydrochloride intravenously at once. Morphine should be given in sufficient dosage to relieve the pain and the anxiety. The patient should be placed in a semi-upright posture and be permitted to breathe air with oxygen. If death is not almost immediate but if the signs point to a massive embolism, the question of operation should be considered with due respect for both the seriousness of the condition and the seriousness of the operation. The operation for extraction of the embolus from the pulmonary artery was first done (unsuccessfully) by Trendelenburg in 1908. The first successful operation was performed by Kirschner in 1924. Up to 1939 the operation had been reported 160 times, and in 10 cases the operation apparently saved the patient's life. De Takats has made the rule that if the patient is alive from 5 to 10 minutes after the embolism has occurred and if there is no evidence of improvement and the patient has lost consciousness, an attempt to remove the embolus surgically should be considered. It should be undertaken only by a trained surgical team, and if the necessary set of instruments has been sterilized previously and is ready for immediate use.

## URINARY-TRACT INFECTION

Urinary-tract infection is one of the more frequent postoperative complications, although by reducing the incidence of catheterization following laparotomies, it has been

\* Allen, Arthur W., Lenton, Robert R., and Donaldson, Gordon A.: Thrombosis and embolism, *Ann. Surg.* 118:738, 739, 1943.

greatly lessened on our service. The problem of voiding after major plastic operations is still not solved satisfactorily, and we encounter a considerable number of urinary-tract infections after such operations and a few after laparotomies. The infections are of three clinical types:

1. Simple traumatic urethritis
2. Cystitis
3. Pyelonephritis ("Pyelitis")

It is essential to treat these conditions promptly and vigorously; for, if neglected, they may result in chronic infection which is eliminated with great difficulty or, in rare cases, persists in spite of all treatment.

**Simple Traumatic Urethritis.** Trauma to the urethra from repeated catheterizations is inevitable, as is irritation from an indwelling catheter. The urethra, from internal sphincter to the meatus, becomes edematous and is invaded by the nonspecific bacterial flora, ever present in the region of the meatus. Burning on urination results, and there may be some frequency if the trigone is involved in the irritation. This is particularly apt to be the case if an indwelling catheter of the mushroom type has been lying on the trigone. These symptoms usually can be cleared up readily simply by forcing fluids and alkalization of the urine after the patient has started to void. A bladder instillation of Intracaine in oil may give quick symptomatic relief. However, one should not assume that only the urethra and the trigone are irritated mechanically, but a urine culture should be taken.

**Cystitis.** As mentioned in the section on postoperative care of the urinary bladder, cystitis may result from the introduction of organisms by repeated catheterization or an indwelling catheter. Catheterization followed by overdistention or neglected residual urine is the greatest etiologic factor. The symptoms of frequency, burning and dysuria appear, usually with little or no elevation of temperature. If the temperature is over 100°, one should strongly suspect involvement of the upper urinary tract. The organisms involved in postoperative cystitis will be considered in the section on pyelonephritis.

**Acute pyelonephritis ("pyelitis")** usually makes its appearance within 2 weeks after

the operation with a sudden high fever. Often a chill precedes the fever. In a large number of the cases burning and frequency of urination precede the fever by a few days. Pain in one or both flanks is common, but some patients have no discomfort except the malaise and generalized aching, dependent upon the high fever. Since the right kidney is involved more often than the left, right flank pain is the more frequent. The fever is usually of the spiking type, attaining an elevation to 103° or more in the afternoon or the evening and dropping to normal, or near normal, in the morning. An afternoon or evening chill usually precedes the next elevation of temperature. The spiking type of fever is not invariable; in a minority of cases the elevation persists. The patient appears ill when the temperature is elevated, but when the temperature is down she looks, and often feels, remarkably well. On the whole she appears less ill than the patient with an equivalent temperature due to intraperitoneal infection. When the temperature eventually remains normal, the patient changes rapidly to a comparatively well appearance. Nausea, vomiting and distention are commonly present. Usually, there is tenderness in one costo-vertebral angle, occasionally in both, indicating bilateral involvement. Tenderness may extend along the course of the ureter, and the suprapubic region as well as the anterior vaginal wall may be tender on palpation of the bladder. The muscles over the affected kidney may show considerable spasm.

A catheterized specimen of urine should be taken when any or all of the above symptoms or signs appear. It should also be taken when there is an abnormal temperature elevation during the postoperative period, without any signs or symptoms to give a clue to its origin. Usually, the specimen will show an abundance of pus. Very rarely the edema of the ureter temporarily occludes the ureteral lumen completely, and the urine is free from pus. If the clinical picture suggests pyelonephritis and the urine is clear, one should repeat the examination of the catheterized specimen daily; eventually, a specimen may show much pus. Often with the appearance of an abundance of pus the temperature suddenly falls. In this group of postoperative

febrile patients with symptoms pointing to kidney infection, but without pus in the urine, one always should consider the possibility of a ligated or cut ureter.

When the catheterized specimen is obtained, a urine culture should be taken in order to determine as soon as possible the specific organism responsible for the infection. A knowledge of the type of organism is helpful in the management of the chemotherapy and in prognosis. In an analysis of 500 consecutive positive renal cultures from our clinic, Everett obtained the following results:

ORGANISMS	NUM- BER	PER CENT
Pathogenic bacilli	280	56.0
<i>Escherichia coli</i>	179	35.8
<i>Aerobacter aerogenes</i>	59	11.8
<i>Proteus</i> sp.	23	4.6
<i>Bacillus pyocyaneus</i>	11	2.2
<i>Alcaligenes faecalis</i>	3	0.6
<i>Paracolon bacillus</i>	3	0.6
<i>Shigella dispar</i>	2	0.4
Pyogenic cocci	162	32.4
<i>Staphylococcus albus</i>	98	19.6
<i>Alpha Streptococcus faecalis</i>	29	5.8
<i>Staphylococcus aureus</i>	18	3.6
<i>Alpha streptococci</i>	17	3.4
Nonpathogenic organisms (possible contaminants)	58	11.6
<i>Diphtheroids</i>	34	6.8
<i>Bacillus subtilis</i>	23	4.6
<i>Sarcina</i>	1	0.2

In a series of cases consisting exclusively of postoperative infections, there probably would be a higher percentage of the coliform group because more of the infections are introduced by the catheter.

The mode of invasion of the kidney during the postoperative period cannot be stated with certainty, but it is interesting to speculate concerning it, and it has a practical application in prevention and treatment. The ascending route through the ureteral lumen is suggested by the fact that pyelonephritis occurs more frequently in those cases in which postoperative catheterization has been done and especially in those who have been permitted to become distended or retain residual urine after voiding has begun. The ascending route is also suggested by the fre-

quency with which there is a history suggesting cystitis for a few days before the onset of the fever and discomfort in the kidney region. The theory of ascent of the infection, via the ureteral lumen, is one of the earliest. It fell into disfavor after the demonstration of a valvelike action at the ureterovesical junction. Reflux of opaque media up the ureters in doing cystograms has been demonstrated repeatedly in long-standing bladder infections when fibrosis about the orifices prevents their closing mechanism from working perfectly. However, such fibrous changes in the bladder wall do not occur in the recently acutely inflamed postoperative bladder. Nevertheless, Kretschmer has shown by cystography that vesicoureteral reflux does occur at times when the bladder is quite normal. If this is possible and if one adds to this the factors of vesical distention plus infection by catheterization, it would seem probable that the majority of cases of postoperative acute pyelonephritis are the result of ascending infection.

The theory of ascending infection fails to explain all cases of postoperative kidney infection, as well as all cases of pyelonephritis occurring at other times. After all, postoperative pyelonephritis occurs in some patients who empty their bladders completely from the time of operation and have no bladder symptoms preceding the chills and the fever that indicate kidney involvement. The possibility of lymphogenous invasion of the kidney from the large bowel is admitted by most students of the subject. Franke has shown a direct communication between the lymphatics of the colon and the kidneys. This communication is especially direct between the colon and the right kidney. This coincides with the clinical fact of the greater incidence of pyelonephritis on the right side. Everett, Scott and Steptoe have conducted clinical experiments which would seem to substantiate the idea of kidney infection with *Escherichia coli* via the lymphatics. It has been shown that sulfasuxadine is very effective in reducing the count of coliform bacilli in the intestinal tract, but the absorption of the drug in the blood is very slight as shown by very low blood levels, in spite of heavy dosage. In a series of about 40 cases of *Escherichia coli* kidney infection the urine became sterile

within about a week. The authors reasoned that these rapid results could hardly be attributed to direct action of the drug on the kidney infection, since absorption of the drug by the blood is so slight. They concluded that the most likely explanation of the disappearance of the organisms from the urine was the elimination of the source of the infection within the colon. It would seem that these results substantiate the theory of infection by the lymphogenous route from the colon. As applied to postoperative pyelitis, one might reason that the stasis of the intestines during bed rest would tend to increase the chances of lymphogenous absorption of bacteria from the bowel. It is well known also that the periureteral tissues have lymphatic channels, and there also exists the possibility of extension via these from the bladder to the kidneys.

The theory of hematogenous infection, which was vigorously supported by Cabot and Crabtree, finds some support in certain cases of postoperative pyelonephritis, particularly the infections of the coccal type. The relationship between coccal infections of the kidney and distant foci such as boils, carbuncles and paronychia has been amply demonstrated. Slight coccal infections of the incision are not uncommon in gynecologic operations, and it would appear likely that these infections could act as foci for blood-stream invasion and kidney involvement. Even the possibility of organisms of the coliform group invading the kidney by the blood stream cannot be excluded.

It has been shown by Hunner that urinary stasis is an important factor in infection in the urinary tract. All with experience in urology see evidence of this in their daily clinical observations. The edema produced in the pelvic tissues by both laparotomy and extensive vaginal plastic operations must extend, in many instances, to the periureteral regions and the ureteral wall itself. Such edema is temporary, but for several days after operation it could interfere with drainage through the ureters and thus augment the chances of kidney infection. If a pre-existing ureteral stricture is present, less postoperative edema would be required to bring the obstruction to the point of producing sufficient stasis to result in infection.

## TREATMENT

The symptoms of traumatic urethritis resulting from repeated catheterization or an indwelling catheter usually can be alleviated completely within a day or two by forcing fluids and alkalization of the urine with 4 Gm. of soda bicarbonate 3 times daily. A urine culture always should be taken when symptoms of urethral or trigonal irritation develop; if the urine contains bacteria, chemotherapy should be instituted. Symptoms of acute cystitis usually can be relieved with instillations of Gomenol or Cajedrol. These oils have little or no antiseptic properties, but a half ounce left in the bladder often greatly reduces the acute distress. Instillations of silver nitrate solution (1-1,000) should be made every 2nd day when catheterization is done to obtain a culture as a check on the chemotherapy.

When pyelitis is present, bed rest should be prescribed. Formerly, patients with pyelitis were placed in Fowler's position, but the advantage of doing this is doubtful. In fact, Vermooten believes that elevation of the foot of the bed to prevent ptosis of the kidney and ureteral kinking is desirable. A good fluid intake should be obtained, either by mouth or by the intravenous route. Since many patients with pyelitis are nauseated and will not tolerate forcing fluids by mouth, glucose and saline solution should be given intravenously. A total fluid intake of from 3 to 4 liters a day tends to flush kidney tubules, kidney pelvis, ureters and bladder. Alkalinization of the urine with soda bicarbonate tends to alleviate bladder distress and prevent the deposition of crystals of the sulfonamides.

The value of sulfonamides and antibiotics in the treatment of urinary-tract infections has been well established. With the great assortment of antibiotics available today at times one is left with a sense of confusion as to the treatment of choice. Culture of the catheterized urine should be done at once; and if laboratory facilities are available, sensitivity tests should be set up as soon as the organism is grown. If the facilities for sensitivity tests are not at hand, at least the organism should be identified. Sufficient tests in vivo and in vitro have been made so that

the sensitivity of most of the common organisms to the various antibiotics is generally fairly well established, and treatment can be instituted on the basis of this knowledge. However, while cultures are growing the patient is suffering, and therapy should not be withheld until cultures and the sensitivity tests are complete. Since a large majority of the cases are infected with gram-negative organisms that are susceptible to sulfonamides, treatment may be started immediately with one of them. After trying most of the sulfa drugs we have concluded that sulfisoxazole (Gantisin) is as effective as any, and rarely is it toxic to the patient. The dosage is 1.5 Gm. 4 times a day. Within a few days symptoms will have abated in the great majority of cases. As a guide to further treatment catheterized specimens should be examined and cultured several days after the cessation of therapy. If the symptoms and/or infection persists in spite of adequate therapy with sulfisoxazole, one may select an antibiotic. Nitrofurantoin compounds (Furadantin) in doses of 100 mg. 4 times a day has often proved to be highly effective in resistant organisms. When given at times other than directly after a meal, the drug is often tolerated better with a lump of sugar.

It should be remembered that polymyxin has nephrotoxic effects. The toxic symptoms may occur after the first dose and may consist of paresthesias, hypesthesia, dizziness, weakness and malaise. Although they continue throughout therapy, they cease as soon as the drug is stopped. This is not true of the untoward symptoms which are not uncommonly due to chlortetracycline. Nausea, diarrhea, intestinal cramps and inflammation of the perianal region, which may extend to the vulva and the vagina, commonly occur and may be very persistent. Although chlortetracycline has a wide antibiotic spectrum, the rather frequent occurrence of these symptoms has dampened our ardor for it, and we have been inclined to try other antibiotics before resorting to it.

With acute pyelitis the bowels should be kept well open with mild laxatives and enemas, if necessary. By these measures distention is reduced, and if there is constant reinfection from the bowel by the lymphogenous route this would tend to be reduced.

We lean very much to the conservative side on the question of instrumentation during the acute stage of pyelonephritis. The passage of a ureteral catheter during the acute phase of the average case of pyelonephritis is contraindicated. This opinion is at variance with the teaching of some urologists. We recognize the fact that the ureter is often obstructed due to ureteritis and swelling of its wall and we also acknowledge the desirability of drainage in clearing up renal infections. In many cases of acute pyelonephritis the passage of a catheter up the ureter brings down the temperature promptly. However, when the catheter is withdrawn, there is the added edema due to the trauma of the catheterization, and frequently the ureteral lumen is occluded again, and the acute symptoms recur. Therefore, we restrict the use of an indwelling ureteral catheter to those cases in which the temperature continues for several days after the patient has been under chemotherapy. If the operator has reason to suspect that he may have injured or ligated the ureter at operation, ureteral catheterization may be attempted earlier. If the ureter is catheterized, a rather large catheter with an open end should be used (No. 8 or 9 F). It is left in place for several days and irrigated twice a day—oftener if necessary—with a small amount of sterile water. Pelvic lavage with antiseptics was once thought to have great therapeutic value. We are inclined to regard irrigation of value only in so far as the passage of the catheter improves drainage, since the efficacy of any antiseptic upon the renal parenchyma, which is always involved, is nil.

During the period of treatment, diet adequate to maintain nourishment should be given, if possible. However, both solids and fluids may be poorly tolerated. In such instances a mixture of 5 per cent glucose in saline solution should be given freely intravenously. This should be given in sufficient quantity to maintain an intake of 3 or 4 liters daily. The flushing of the kidneys in this physiologic manner, which washes out the tubules, the kidney pelves, the ureters and the bladder without the least trauma, is far superior to retrograde flushing through a catheter.

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# Retrodisplacement of Uterus

## HISTORY

The recognition and the surgical correction of retrodisplacement of the uterus form an interesting chapter in the development of gynecology. In 1955 Frederic Fluhmann wrote a review of the subject, and in this brief historical sketch I have drawn heavily from his work. He who fails to heed the mistakes of the past is apt to repeat them. With this in mind I have considered it worthwhile to sketch briefly this history.

During the early part of the 18th century retrodisplacement of the uterus became identified as an obstetric complication. In 1774 William Hunter described at autopsy a uterus impacted in the hollow of the sacrum during the 5th month of pregnancy which was dislodged with difficulty. During the 18th century retrodisplacement was considered an acute complication of pregnancy, occurring during the 4th and the 5th months of pregnancy and often resulting in death. Death resulted, too, from fatal injuries dependent upon forceful attempts at displacement. Denman in 1782 considered *overdistention of the bladder the chief cause of the condition and recommended repeated catheterization as the essential treatment.*

In Howard Kelly's review of the subject he calls the early part of the 19th century the "pessary period." It was then that retrodisplacement become recognized in the non-pregnant state, and many ingenious instruments and technics were devised for bringing the uterus forward and holding it there. Churchill in 1859 described the symptoms as greater menstrual flow, pelvic engorgement, greater tendency to abortion, a sensation of depression and falling of the womb, pain, difficult and frequent urination, dull backache, a sense of pressure in the rectum,

pain down the thighs, leukorrhea and interference with general health. Even then Nauche stated that the condition could exist without symptoms, but unfortunately no one heeded him. Although J. Marion Sims was a strong advocate of the use of pessaries, he cited several instances of vaginal ulceration, vesicovaginal and rectovaginal fistula resulting from their use. He believed that no one who did not possess mechanical ingenuity should attempt to insert a pessary. He himself shaped each pessary individually to the vagina using "block tin or gutta percha softened with a little lead."

In the latter part of the 19th century there began what Fluhmann calls the "dark ages of operative furor." Alexander and Adams are credited with doing the first abdominal uterine suspensions. Alexander performed his first one in 1881, and Adams in 1882, but the latter recorded the operation first in the literature. The operation soon attained great popularity, and numerous modifications were described. Kelly in 1914 collected over 50 types of suspension, and in 1925 Crossen collected 110. Three years later Hadden collected 120. There was a veritable orgy of operating. Alexander became so enthusiastic about uterine suspension that on one occasion he was asked to demonstrate the operation for some visiting surgeons. He sent 4 assistants north, south, east and west throughout Liverpool to find a suitable case. They returned empty-handed, saying that in all Liverpool they could find no woman who had not had the Alexander operation performed on her. Howard Kelly stated that he personally had done over 1,000 suspensions, and Barton Cook Hirst reported "hundreds." In the Woman's Hospital in New York, George Ward reported 3,357 abdominal

suspensions among 22,625 gynecologic operations. By that time, and even before, skeptics were raising some questions. Scanzoni wrote in 1850, "My decided conviction is that the mechanical treatment of this affection of retrodisplacement . . . is either useless or positively mischievous." Although J Montgomery Baldy devised a method of uterine suspension, he wrote, "Like the poor, the subject seems to be always with us. There come periods of quiescence in its discussion, but nothing, however, conclusively leads us near the goal. . . . We should not discuss the treatment of retrodisplacement but treatment of conditions in connection with which retrodisplacements of the uterus occur as an incident."

In 1914 there was a symposium on the subject in Philadelphia. At that time Baldy said, "In my opinion nine-tenths of the operations performed on women for retrodisplacement are uncalled for. . . . Dr. Cragin is such an old and warm friend that I would hate to tell him what I thought of him for doing 200 retrodisplacement operations in a single year. . . . If you recall the fact that Kelly has performed about 1,000 operations for retrodisplacements before he discovered that the several procedures he was following were incompetent, you will wonder with me what in the world became of those 1,000 women. . . . I am sorry to say it but it looks to me as though the possible number of retrodisplacement operations performed in this country is limited only by the number of females in existence."

In spite of these freely expressed critical attitudes, Aldridge in 1940 stated, "Retroversion of the uterus will probably always be one of the more common gynecological conditions requiring treatment and surgical intervention for the cure of symptoms in some cases."

Within the past 3 or 4 decades there has been a gradual reduction in the number of operations done. In our own clinic, for example, we performed 3,374 operations last year, among which there were no abdomens opened primarily for uterine suspension. However, in the preceding year 3 primary suspensions were done. What factors have brought this about? In the first place, on the face of it, it would seem unlikely that a con-

dition which occurs in 20 to 30 per cent of the population would require correction. Another factor which contributed to the rejection of the suspension operations was the failure of many operative procedures to hold the uterus in position. But more important still was the failure of relief of symptoms even when the uterus was held in perfect position. Then, too, there were a few serious postoperative complications. Finally, a better understanding of physiology and endocrinology in relation to infertility and abortions has made gynecologists less anxious to perform uterine suspension. A better understanding of the orthopedic causes of low back pain has also kept many women from unnecessary surgery.

Fluhmann concludes his historical review with an expression of his own views on the subject of uterine suspension: "It is not necessary for adequate gynecologic practice. At most it occasionally may play a secondary role to other procedures such as peritonization of the pelvis, conservative treatment of endometriosis, correction of certain vascular disorders and plastic reconstruction of the fallopian tubes."

With this historical background, I shall attempt to express my personal view in the present chapter.

## ANATOMIC CONSIDERATIONS

Before discussing the correction of the retrodisplaced uterus, the anatomic structures and the mechanism by which the uterus is held in its normal position of antelexion and anteversion should be reviewed. The portio vaginalis points postero-inferiorly, and the corpus is bent with a wide obtuse angle on the cervix, so that when the woman is erect the corpus lies practically horizontally, resting loosely upon the bladder. There are minor variations in the direction of the axis of the cervix and the corpus which must be considered to be within normal limits. There are also physiologic displacements due to distention of the bladder or to pregnancy; during the latter part of pregnancy the uterus becomes a practically vertical organ.

The fibromuscular tissue lying beneath the peritoneum and attached to the cervix forms certain ligaments which play an important part in maintaining the uterus in anteposi-

tion. The tissue within the lower portion of the broad ligament, extending from either side of the cervix to the side of the pelvis, forms the *ligamentum transversalis colli* (Mackenrodt), the so-called cardinal ligament. The 2 cardinal ligaments have as their chief function the maintaining of the cervix at its normal level. They are discussed more fully when uterine prolapse is considered, but uterine retrodisplacement cannot be considered independent of prolapse. As retrodisplacement plays an important part in the descent of the uterus, so descensus causes the corpus to fall back from its normal position. Beneath peritoneal folds, on either side of the cul-de-sac of Douglas, are 2 fibromuscular structures, usually well developed, the uterosacral ligaments. They are attached to the posterolateral surface of the cervix and proceed backward on either side of the rectum, to be inserted into the periosteum of the sacrum, thus holding back the cervix. The uterus is normally an organ of some rigidity. If the cervix is held backward and the corpus lies forward, the intra-abdominal pressure falls upon the posterior surface of the horizontal corpus and maintains it in ante-position. If the uterosacral ligaments are congenitally inadequate or have become so through childbirth, the cervix moves forward. Under such conditions the uterus, swinging on a more or less fixed transverse axis at about the level of the internal os, moves backward, and the intra-abdominal pressure falls on the anterior surface of the corpus, aggravating the retrodisplacement.

The round ligaments also serve an important purpose in holding the uterus in ante-position; advantage is usually taken of this in correcting, surgically, its malposition. Upon opening the abdomen and inspecting the normal pelvis, it is obvious that the round ligaments do not tautly hold the fundus forward. How then can the round ligaments play such an important role in maintaining the ante-position? It is because of their function in bringing the fundus back to ante-position after its physiologic displacement. If the uterosacral ligaments hold the cervix back and the round ligaments replace the corpus to its forward position after displacement from a distended bladder or pregnancy, intra-abdominal pressure will maintain it there.

Another factor in keeping the uterus in normal position is the tonus of the musculature of the uterus itself. When the tonus is firm, the corpus is easily maintained forward by the mechanism described above. However, when the musculature is flabby, coils of intestine which have worked into the vesicouterine pouch may force the body backward on the cervix in a hingelike manner. Once the retroflexion is begun, it can be completed easily by intra-abdominal pressure upon the anterior uterine surface. As a matter of fact, in most cases of retrodisplacement there is a combination of retroversion and retroflexion, although either may exist independently.

The term "retrocession" has been applied to a posterior displacement of the entire uterus while the normal ante-flexion of corpus onto body persists. In fact, the ante-flexion may be exaggerated beyond the normal, even when the uterus as a whole lies back. Retrocession is usually congenital and often associated with a uterus of subnormal size. Frequently, the cervix is much longer than normal, while a small corpus is acutely ante-flexed on it.

#### SYMPTOMATOLOGY IN RELATION TO TREATMENT

In considering the treatment of retrodisplacement of the uterus, it is essential to consider the symptomatology. At the onset it must be emphasized that in the majority of cases retroversion gives rise to no symptoms at all. In another large group of cases the symptoms are slight and do not justify an abdominal suspension. It is generally estimated that 1 out of 5 women has a congenitally retrodisplaced uterus. One of the commonest findings in making routine pelvic examinations is retrodisplacement of the uterus in women who are completely free of symptoms, and it is our opinion that such uteri should not be suspended. Occasionally, one hears the opinion expressed by surgeons that retrodisplacement, even though asymptomatic, may lead to "degeneration of the ovaries." We do not share this view and have seen no pathologic evidence to support it. This opinion, together with a desire to operate, has resulted in subjecting great numbers of women to needless suspensions, so that even today many suspensions are per-

formed which could be avoided. How common it is to encounter women who have had uterine suspensions for backache of orthopedic origin, frequency of urination or symptoms of a general neurasthenic nature that have no relation to the position of the uterus and are only exaggerated by useless surgery! One should consider seriously, in all cases in which uterine suspension is contemplated, whether or not the symptoms of which the patient complains are due to the misplaced uterus; this may be difficult, and the best clinical judgment is necessary in order to arrive at a proper decision. It should be remembered that the operation is never an emergency, and one can afford to observe the patient for a time before making a final decision. In most cases the therapeutic test of holding the uterus in position for a few months with a Smith-Hodge pessary can be used to advantage. Unfortunately, it is not always possible to hold a uterus in position by means of a pessary; when it is possible, frequently one can determine by the relief obtained whether or not a suspension is indicated.

In general, it may be said that an uncomplicated, retroposed uterus is less apt to be responsible for symptoms than one complicated by other intrapelvic disease. Among the conditions commonly associated with and frequently a factor in the cause of retrodisplacement are: salpingitis, endometriosis, ovarian tumors, myomata and childbirth injuries. Often these conditions are responsible for symptoms which, in themselves, necessitate surgery, but frequently complete relief will not be obtained without a proper suspension of the uterus, together with the correction of the other pelvic lesions. It should not be lost sight of, however, that even the complicated retrodisplaced uterus may be asymptomatic. How frequently an adherent retroverted uterus is encountered with the residue of an old salpingitis, without causing the patient any discomfort!

In order to evaluate the symptoms with reference to treatment, a consideration of individual symptoms is in order.

**Backache and Bearing-Down Abdominal Discomfort.** For many years the question of the relation of retrodisplacement of the uterus to backache has been a controversial one. It

is true that innumerable retroverted uteri have been suspended because of backaches for which they were not responsible. This has induced some gynecologists to take the view that an uncomplicated, retrodisplaced uterus cannot cause backache. Our experience has not forced us to such an extreme position; gratifying results obtained by suspending uteri in certain selected cases strongly contradict such a view. Lynch found backache to be present in half of the patients with retroversion. However, this does not indicate that half of the women with retrodisplacement suffer from backache as a result of the position of the uterus. The percentage is obviously much smaller. Lynch relieved backache in 81 per cent of the patients upon whom he operated.

Sacral or lumbosacral backache and bearing-down abdominal pain are considered together, because when these are due to retrodisplacement they usually occur together and appear to the patient to be inseparable. Often she describes her discomfort by bringing her hands around from her back into the lower quadrants in order to indicate bearing-down discomfort. The backache and the abdominal discomfort are usually dull in nature and increase as the day goes on. If the patient complains of backache before she arises in the morning, and particularly if she gets relief on becoming active, one can be quite sure that the position of the uterus is not responsible for the pain. Such a clinical picture is often seen as a result of a mild lumbar arthritis in which the patient has less discomfort as she "loosens up." When one is doubtful about the etiologic relationship between the position of the uterus and the backache, the patient should be examined orthopedically. If the orthopedist fails to find a definite cause for the back discomfort, the therapeutic test of the pessary is invaluable. If the uterus is held up with the pessary and the backache is relieved only to return when the uterus falls back after the pessary is removed, one can be quite sure that a suspension will give relief.

**Disturbances of Menstruation.** Any type of disturbance of menstruation may be present with retrodisplacement of the uterus, but in most instances the position of the uterus has no etiologic relationship to the disturb-

ance. For example, amenorrhea, polymenorrhea, hypomenorrhea and oligomenorrhea of endocrine origin occur with the retroverted as well as with the anteverted uterus, and a correction of the uterine malposition will have no curative effect on the menstrual disorder. Likewise, one is never justified in explaining intermenstrual bleeding on the basis of retrodisplacement. Also, menorrhagia or hypermenorrhea usually can be explained as attributable to another cause, although in some instances the retrodisplacement is responsible for the increased menstrual flow. The passive venous congestion of the uterus lying in the cul-de-sac may cause increased bleeding from the denuded menstrual endometrium. We have repeatedly seen a reduction of excessive menstrual flow following a uterine suspension.

Often it is difficult to judge the relation of dysmenorrhea to retrodisplacement. So-called idiopathic or essential dysmenorrhea is no respecter of uterine position and is found to occur in the anteverted as well as in the retroverted uterus. On the other hand, there is no doubt, judging from the relief obtained by suspension in some cases, that retrodisplacement of the uterus may cause dysmenorrhea. It is probable that marked retroflexion of the uterus, affording poor drainage of the menstrual flow, is more apt to be a factor in dysmenorrhea than when retroversion exists alone. The menstrual discomfort may take the form of cramps or sacral backache. Since it frequently is difficult to evaluate the relation of uterine position to menstrual pain the therapeutic test of the pessary is again useful here.

**Sterility.** The finding of a uterus in retroposition in a woman complaining of sterility is no indication that the position of the uterus has any relation to the sterility problem. In such cases, a thorough investigation of the sterility must be made in both the male and the female, without regard for the retroposition. It is our opinion that sterility is slightly greater in women with retrodisplacement than in those without. It is possible that the edematous endometrium, seen at times in a large boggy, retroposed uterus, may not afford suitable soil for implantation of the fertilized ovum. However, this opinion is very difficult of proof. One is seldom, if ever,

justified in undertaking uterine suspension for the relief of sterility alone.

**Abortion.** It is doubtful that retroposition is ever responsible for abortion before the 12th week of pregnancy. One sees many unexplained early abortions about which it is impossible to make statements regarding their etiology. However, it is our opinion that these early abortions are no more common in women with retroposed uteri than in others. When abortions occur repeatedly from about the 3rd or the 5th month and are associated with retroposition of the uterus, one may fairly assume that the position of the uterus is the cause. This is particularly true when the uterus is acutely retroflexed, so that its spontaneous rise above the sacral promontory is difficult. In such cases uterine suspension is justifiable, but if the patient is pregnant at the time of consultation, the uterus should be put in position and held there by pessary, until the first trimester of pregnancy is past.

**Nervous Symptoms.** The general nervous constitution of the patient should be taken into consideration when suspension is contemplated. The question frequently resolves itself into this: Is the patient by nature a neurotic individual who is capitalizing on the fact that she has a malplaced uterus, or are her nervous symptoms the result of chronic, pelvic discomfort which has made her irritable and nervously exhausted. Often the answer is difficult, and frequently a period of careful observation is desirable before coming to a final conclusion.

#### SYMPTOMS NOT DEPENDENT ON RETRODISPLACEMENT

Certain symptoms have been, and by some still are, attributed to retrodisplacement of the uterus when, in our opinion, they have no relation to that condition. So these symptoms are worthy of discussion here, because their misinterpretation has resulted in much needless surgery.

**Constipation.** How frequently one sees myomatous uteri of considerable size lying directly on the sigmoid or the rectum without constipation! Is one justified, then, in assuming that the normal-sized, retroplaced uterus lying freely against or slightly to the right of the rectum causes constipation? Con-

stipation is extremely common in parous women, as is retrodisplacement, and it would be remarkable if these two symptoms did not, by chance, frequently occur in the same individual. We never have observed constipation relieved by uterine suspension.

**Leukorrhea** is also attributed by some to retrodisplacement, but an understanding of the underlying lesion behind this symptom scarcely permits one to explain it on the basis of uterine position. The cervicitis or vaginitis causing the discharge may be cleared up by appropriate treatment regardless of the position of the corpus. The error of believing that the retroposition is a factor in causing the discharge depends, we believe, upon the fact that leukorrhea results often from lacerations and infections of the cervix dating from childbirth. Since the symptoms of retrodisplacement frequently date from the same time, it is a common error to assume that the leukorrhea has some relation to the retroposition.

#### Frequency and/or Burning on Urination.

One of the misconceptions of the past was that these symptoms may result from retrodisplacement. They have been ascribed to "the abnormal position of the portio which presses upon the trigone." Many uteri have been suspended for these bladder symptoms without relief. When there is descensus, and particularly when there is an associated cystocele, bladder symptoms may be dependent upon these gynecologic conditions but never upon a simple retrodisplacement. Patients complaining of persistent frequency and/or burning should be examined cystoscopically; often intrinsic disease of the urinary tract will be discovered. At times the urinary tract, in spite of complete investigation, will be found to be quite normal, the urinary symptoms being entirely on the basis of a neurosis. Nothing is more discouraging to the nervous patient than to undergo a uterine suspension in the hope of relief from bladder symptoms, only to realize that the symptoms have persisted.

#### INDICATIONS FOR SUSPENSION

We do not quite agree with Fluhmann that suspension of the uterus is not necessary for adequate gynecologic practice. There are some young women in whom the symptoms

of the retroversion are clear-cut and severe. Most of these are parous women, and often there is slight descensus accompanying the retrodisplacement. We prefer to have such women complete their families, and then we would advise a vaginal hysterectomy and whatever vaginal plastic operation may be indicated. Such advice may not always be agreeable to the patient, but she demands relief from her very troublesome discomfort. Under such conditions, we believe that there is still a place for intra-abdominal suspension of the uterus.

In our clinic we believe it to be indicated frequently in connection with conservative operations such as those done for endometriosis, tubal pregnancy or plastic operations on the tubes for relief of infertility. To leave a uterus in the cul-de-sac while doing the above conservative procedures would be to do incomplete surgery and often not give complete relief.

#### CHOICE OF OPERATIONS

An abdominal suspension of the uterus after the menopause is seldom indicated unless the primary indication for opening the abdomen is the removal of some lesion—for example, a benign ovarian cyst. In most of such instances the opposite ovary and the uterus should be removed, but occasionally because of the age and the general condition of the patient a minimum of surgery should be done. In such a case, one may choose one of several suspension operations, but the oldest one, ventrofixation, may be the quickest and, under the circumstances, the best. This is discussed elsewhere in this chapter. In choosing the best operation in premenopausal women one must consider the likelihood and the desirability of future pregnancies. In the young women in whom future pregnancies are expected, we have found the modified Gilliam suspension to be most satisfactory. We have seen no evidence that it is detrimental to subsequent pregnancies, and we believe that pregnancy does little harm to a properly performed suspension of this kind. Many surgeons have reported satisfactory results with other types of suspensions, and we have no doubt that their results justify their claims. Among the most used in this country are the Olshausen and the Baldy-

Webster. We prefer the modified Gilliam to the Olshausen because it is more nearly correct anatomically. This is not a mere academic preference, for by shortening the round ligaments through the internal inguinal ring, there is left no opening lateral to the point of attachment to the abdominal wall, as there is in the Olshausen, through which loops of intestine may become strangulated. We prefer the modified Gilliam to the Baldy-Webster because in the Gilliam operation the distal and weaker part of the round ligaments are reefed in, allowing the proximal stronger portions to serve in bringing the uterus forward. On the other hand, in the Baldy-Webster the stronger proximal portions of the ligaments are sutured to the posterior surface of the uterus, leaving the weaker distal portions to serve as the functioning portions of the ligaments. The Alexander-Adams extraperitoneal shortening of the round ligaments in the inguinal canals has been almost completely abandoned in this country, although it is still in use in some European clinics; it is a blind operation, and its only advantage lies in the fact that it is extraperitoneal. Before the days of dependable aseptic surgery this was a great advantage, but today the danger of operative infection of the peritoneal cavity is negligible. The operation precludes the possibility of visual examination of the pelvic organs and correction of any accompanying lesions in the pelvis.

Regardless of the type of round-ligament suspension employed, there are cases in which simple round-ligament shortening will not adequately hold the uterus in anteposition. In those cases additional procedures are necessary. One of the more essential of these is shortening of the uterosacral ligaments. This is especially valuable in cases in which some descensus is present or when the cervix is markedly anterior. Another valuable procedure is the suturing of the bladder peritoneum at a point on the anterior uterine wall higher than its normal reflexion. At times, after shortening the round ligaments, the fundus still has a tendency to sag backward. The pull of the advanced bladder peritoneum is frequently sufficient to bring the center of gravity of the uterus forward and thus permit the intra-abdominal pressure to be exerted on the posterior surface.

When the patient has had all the children that she desires and particularly when an extensive vaginal plastic operation is indicated, the best "suspension" may be a vaginal hysterectomy. There is little reason for saving the uterus when it is necessary to operate upon a woman over 40 for symptomatic retroversion. It is doubtful whether a vaginal hysterectomy plus a vaginal plastic operation is as much of an operative procedure as the vaginal plastic plus an abdominal suspension. The removal of the uterus will relieve the symptoms of retroversion and at the same time ensure against future trouble due to functional bleeding or uterine neoplasm. An additional reason for hysterectomy is afforded when dysmenorrhea is a prominent symptom.

#### TECHNIC: MODIFIED GILLIAM SUSPENSION OF UTERUS

A short mid-line incision is usually made, although a modified Pfannenstiel incision is also quite satisfactory. The uterus is brought forward, and a catgut traction suture is placed about one round ligament. The point at which this suture is taken should be such that when both ligaments are withdrawn for suture to the inside of the rectus sheath, the uterus will be in good position. The exact point can be determined only by trial and error, but the average distance is about 3 or 4 cm. from the uterine cornu (Fig. 55 A).

An Ochsner clamp is placed on the edge of the fascia at the level of the anterior superior spine of the ilium. A small Kelly clamp is placed on the peritoneal edge at the same level. The belly of the rectus is then separated from its sheath by blunt and sharp dissection (Fig. 55 B).

A long Kelly clamp is used to circumvent the belly of the rectus at the point where it has been freed, and the peritoneum is pushed up by the nose of the clamp at the internal inguinal ring. An assistant snips the peritoneum over the point of the clamp as the jaws are separated slightly (Fig. 55 C). The point of the Kelly clamp thus enters the peritoneal cavity. The catgut which was previously placed about the round ligament is now placed in the jaws of the long Kelly clamp, and the clamp is withdrawn. This maneuver brings the round ligament out of the peritoneal cavity through the internal inguinal

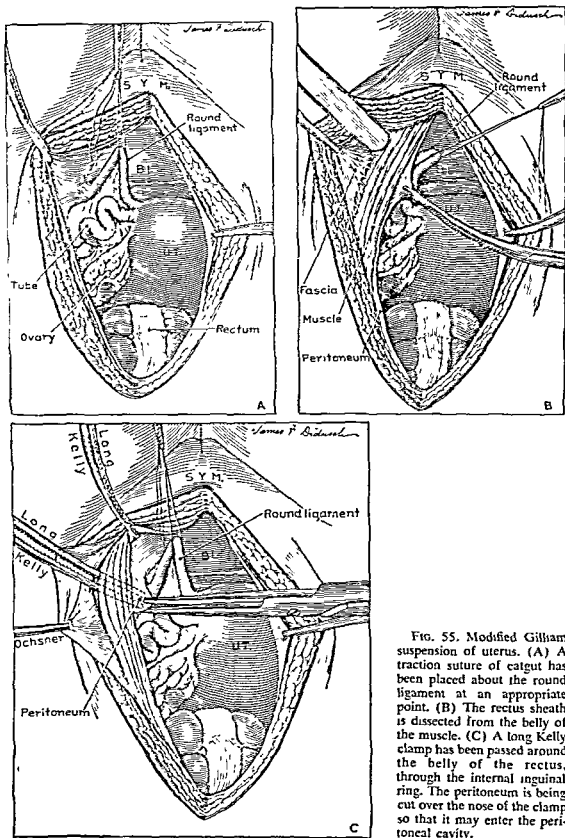


FIG. 55. Modified Gilliam suspension of uterus. (A) A traction suture of catgut has been placed about the round ligament at an appropriate point. (B) The rectus sheath is dissected from the belly of the muscle. (C) A long Kelly clamp has been passed around the belly of the rectus, through the internal inguinal ring. The peritoneum is being cut over the nose of the clamp so that it may enter the peritoneal cavity.



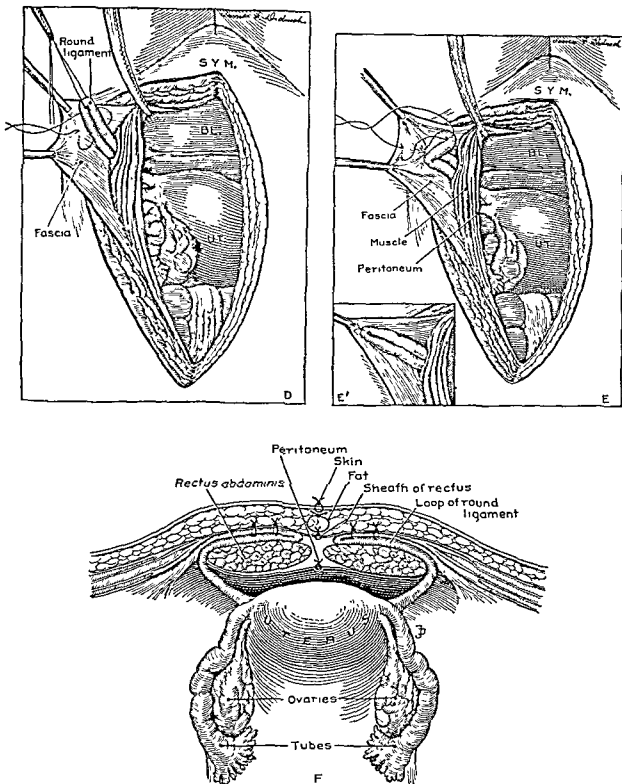


FIG. 55 (Continued). Modified Gilliam suspension of uterus. (D) The traction suture has been grasped by the Kelly clamp and withdrawn through the internal ring. The round ligament is being sutured to the inside of the rectus sheath with medium silk or Pagenstecher linen. (E) Another suture is anchoring the round ligament to the fascia. The inset shows how the round ligament has been sutured to the fascia. None of the sutures encircles the round ligament. (F) Transverse section showing final result.

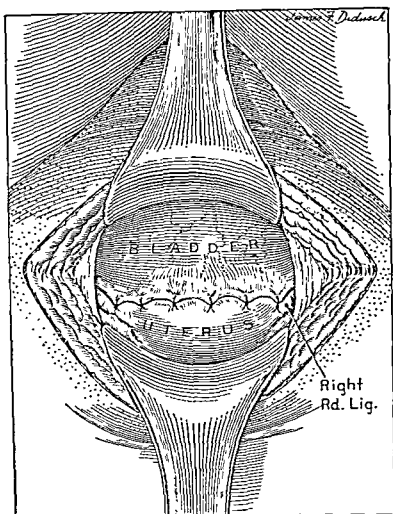


FIG. 56. Advancement of bladder peritoneum onto fundus of uterus. Interrupted sutures of medium silk have sutured a fold of bladder peritoneum high on the fundus of the uterus.

ring, and a loop is brought between the rectus muscle and its sheath (Fig. 55 D). The loop is sutured to the under surface of the fascia with linen or silk sutures. In placing these interrupted sutures care should be taken not to encircle the entire ligament and thus strangulate it, but rather to take substantial bites into the substance of the ligament on both sides and at the end of the loop (Fig. 55 E).

This procedure is repeated on the opposite side.

After the suspension has been done as described, the hand should be introduced into the abdomen to ascertain that there is no loop of round ligament lateral to the point where the ligament has been withdrawn from the peritoneal cavity. Such a loop can exist when the round ligament has been withdrawn

at a point medial to the internal ring, or when all of the lateral segment of the ligament has not been withdrawn from the abdomen. If such a condition is found, it should be corrected to prevent strangulation of a loop of bowel between the ligament and the abdominal wall.

After completing the modified Gilliam suspension one should make certain that the standard suspension satisfactorily suspends the uterus. If it does not, additional methods of supporting the uterus should be utilized. We have found advancement of the bladder peritoneum on the anterior uterine wall and shortening of the uterosacral ligaments of great value. One should also make sure that a knuckle of tube has not been drawn into the internal inguinal ring, as may happen when the traction suture is placed too close

to the uterus. This may cause sterility or predispose to ectopic pregnancy. The final result of the suspension is shown in Figure 55 F.

#### TECHNIC: ADVANCEMENT OF BLADDER PERITONEUM

It is not uncommon to find, after performing any type of round-ligament suspension, that the fundus is not quite sufficiently far forward to permit intra-abdominal pressure to act upon its posterior surface and thus hold the uterus in good ante-position. Often the additional forward placement necessary can be accomplished by advancing the bladder peritoneum to a higher level on the anterior surface of the uterus. This may be done by cutting the peritoneum at its normal reflexion from the uterus onto the bladder, and suturing it to the uterus at a higher level.

There is another method of bladder advancement, which we prefer when it is done in connection with a Gilliam suspension. After shortening the round ligaments by the method just described, the bladder peritoneum is frequently thrown into a transverse fold slightly in front of its normal reflexion onto the uterus; this fold may be sutured to the anterior surface of the uterus well above the normal reflexion without cutting the peritoneum. The suturing may be done with continuous or interrupted sutures of medium silk or linen (Fig. 56). The peritoneal surfaces, thus approximated, heal together, and often the added tilt forward which the uterus receives is sufficient to maintain it in good position. We never have noted any bladder discomfort or disturbance from carrying out this procedure.

#### TECHNIC: SHORTENING OF UTEROSACRAL LIGAMENTS

Shortening of the uterosacral ligaments is accomplished very easily if exposure is adequate. The uterus may be held forward by the hand of an assistant or by means of an abdominal retractor. It is well to have the pelvis free of intestines. If they do not fall back into the abdomen as a result of good anesthesia, they should be packed back with moist gauze. Using medium silk or linen suture material on a round needle, the uterosacral ligaments are brought together and sutured to the posterior surface of the cervix

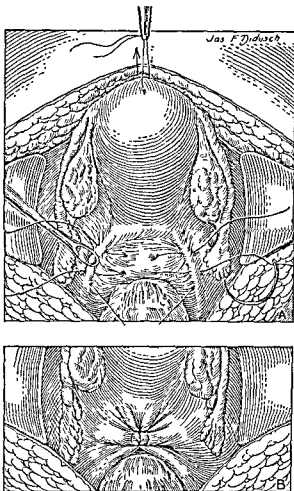


FIG. 57. Shortening of uterosacral ligaments. (A) Interrupted sutures of medium silk or Pagenstecher linen are passed through the uterosacral ligaments and the posterior surface of the cervix. (B) Sutures have been tied, thus shortening the ligaments.

in the mid-line just below the level of their insertion into the uterus. If further shortening is desired, a second similar suture is taken above the first (Fig. 57). The holding of the cervix posteriorly is important in keeping the fundus forward; it also aids in preventing descensus.

#### VENTROFIXATION IN RELATION TO RETRODISPLACEMENT

Ventre-fixation, hysterorrhaphy and hysteropexy were terms applied to the earliest operation in which an attempt was made to suspend the retroplaced uterus. The chief interest of this operation is now historical.

Howard Kelly, who was one of the first to attempt the operation, said in his *Operative Gynecology*:

I just called attention to this mode of relieving retroflexion in Germany in the spring and summer of 1886, when I also secured notes of unpublished cases similarly treated by Dr. Brennecke of Madgeburg, Professor Werth of Kiel, and Professor Sanger of Leipzig, which

were published with an original case of my own. Professor Olshausen of Berlin, who had the subject under consideration at that same time, was the first to publish a paper on it, October 23, 1886. My own paper, entitled "Hysterorrhaphy" and describing a case operated upon April 25, 1885, was read before the Philadelphia Obstetrical Society, November 4, 1886, and published in the *American Journal of Obstetrics*, January, 1887.

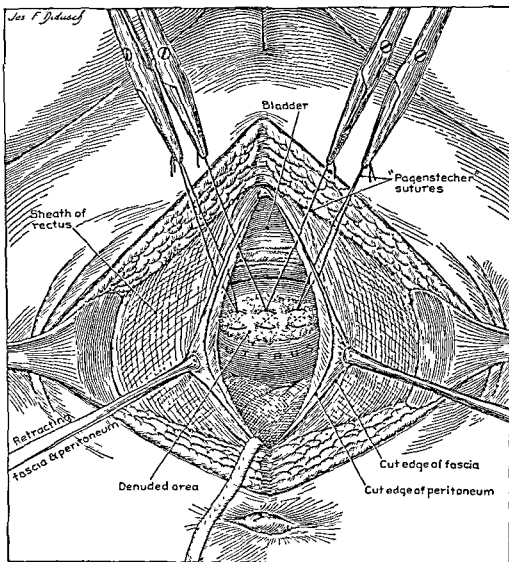


FIG. 58. Ventral fixation of uterus. Fundus is scarified. Three figure-of-eight Pagenstecher sutures are placed in the fundus. Two are brought out laterally through the peritoneum, the muscle and the fascia. These are tied with the peritoneum open. The middle suture is brought out through the peritoneum and the fascia, one thread on either side. This suture is pulled up and tied as the peritoneum is closed.

The disadvantage of this operation is obvious in women who are candidates for further pregnancies. Nevertheless, many women have gone to term following ventrofixation, but the incidence of abortion is high. Several operations for retrodisplacement, more nearly correct anatomically, have been used extensively which are much more compatible with the complete course of pregnancy.

It is our opinion, however, that there remains a very rare indication for ventrofixation of the retrodisplaced or potentially retrodisplaced uterus, and therefore this procedure, which is generally considered outmoded, is included here. The place of this operation in relation to uterine prolapse is considered on page 146. It is our custom, in those cases in which preservation of the uterus is thought to be desirable when doing a salpingectomy, to suspend the organ by a modification of the Coffey technic as described elsewhere in this volume. In rare cases the double salpingectomy may be difficult and prolonged, or for other reasons the condition of the patient may require a rapid termination of the operation. To perform a bilateral Coffey suspension requires a few minutes which may be saved by doing a rapid ventrofixation instead, as one closes the abdomen. Since the patient has been already sterilized by salpingectomy, there can be no

objection on the basis of future pregnancies, and it is better than to allow the uterus to drop back in the pelvis where it may become adherent in retroposition and cause symptoms.

#### TECHNIC: VENTROFIXATION

The uterus is delivered anteriorly, and the fundus, which is to be fixed to the anterior abdominal wall, is scarified as shown in Figure 58. Three figure-of-eight sutures of medium silk or Pagenstecher linen are placed in the fundus. The ends of the two lateral sutures are rethreaded and carried out through the peritoneum, the muscle and the fascia. The ends of the middle suture are rethreaded and passed through the peritoneum and the fascia near the edge of the incision.

The two lateral sutures are tied, but not the middle suture at this time. The peritoneum is closed with a continuous suture of No. 2 plain catgut. As the closure approaches the point at which the fixation is done, the operator reassures himself that there is no loop of bowel between the fundus and the abdominal wall. Then the fundus is brought up against the parietal peritoneal wall by tying the middle Pagenstecher sutures. Then the closure of the peritoneum is completed.

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# Prolapse of Uterus

## GENERAL CONSIDERATIONS

The subject of the best treatment of uterine prolapse and its allied conditions is still one to evoke discussion and disagreements in gynecologic circles. In many clinics in this country vaginal hysterectomy is done routinely and is considered to be the answer to all degrees of prolapse. In others the Manchester operation, with modifications, is thought to be the universal answer. The interposition operation has lost greatly in popularity. It is rare today to encounter a gynecologic surgeon who would advocate a combined procedure of vaginal plastic and intra-abdominal suspension. Doing the entire operative procedure via the vagina represents real progress as illustrated by the results which are far better than those obtained in former years when combined procedures were common.

In our opinion one should not approach the subject with a fixed plan. Each case should be treated as an individual problem. Indeed, the surgeon should be privileged to modify his plans as he proceeds with the operation and evaluates the structures as they are encountered during the dissection. The most important factors to be kept in mind in evaluating an individual for type of operation are:

1 The age and the general physical condition of the patient.

The desirability of preserving menstruation.

The desirability of preserving the child-bearing function.

The degree of descensus.

The condition of the cervix and the corpus uteri.

The presence and the degree of cystocele.

The presence and the degree of rectocele or enterocele.

All of these factors will be considered in discussing the various operative procedures described in this book for the cure of prolapse and allied conditions.

As we express our opinion on the various operations we realize fully that there is room for honest difference of opinion on this subject. Without doubt, in many cases equally satisfactory results may be obtained by more than one method. If this were not true there would not be such strong adherents of the different types of procedure. It is assumed that each surgeon who strongly defends a particular operation does so believing that that procedure is giving satisfactory results in his hands. There is no doubt that the skill of the individual operator, in a particular operation, is a great factor in his results. *But no matter how skillful a surgeon may become in a favorite procedure, he never should permit his enthusiasm for it to overcome his judgment as to its indication.*

## ANATOMIC CONSIDERATIONS

In discussing the cure of prolapse of the uterus it is advisable to consider first the supporting structures that have failed to hold the uterus in correct position and how best to utilize them in restoring the uterus and the vagina to their normal positions, or in supporting that portion of the uterus which is permitted to be retained and the vagina.

The structures concerned in maintaining the uterus in normal position are:

1. The round ligaments.

2. The uterosacral ligaments.

3. The bases of the broad ligaments (cardinal ligaments, ligamentum transversalis colli, Mackenrodt).

4. The fascia lying between the anterior vaginal wall and the bladder (subvesical fascia or pubovesicocervical fascia).

5. The fascia lying between the posterior vaginal wall and the rectum.

6. The floor of the pelvis (the levator ani muscles).

**Round Ligaments.** The function of the round ligaments is to draw the uterus forward to its normal anatomic position after it has been displaced backward physiologically by bladder distention or pregnancy. Once returned to its normal position forward, the intra-abdominal pressure on the posterior surface of the uterus holds it forward. Increased intra-abdominal pressure, such as that caused by straining at hard work or defecation, causes slight temporary descent of the anteposed uterus. If the supports of the uterus are adequate, the uterus promptly returns to its former level. When the uterus is retroposed, or when the round ligaments fail to bring it forward after physiologic displacement backward, intra-abdominal pressure tends to force the uterus downward into

the vagina like a piston in a cylinder. If the other supporting structures are sufficiently firm, the uterus may be maintained at its normal level despite the mechanical disadvantage of retrodisplacement, but a greater strain is put on the other supporting structures than when the uterus is anteverted.

**Uterosacral Ligaments.** The uterosacral ligaments, which are part of the endopelvic fascia lying subperitoneally, extend from the cervix back to the sacrum; they hold the cervix back and also aid in holding it up. Congenitally long ligaments, or ligaments which have lost their tonus as the result of pregnancy, permit the cervix to be displaced forward and downward; this allows the corpus to be displaced backward until the axis of the uterus and that of the vagina coincide. Intra-abdominal pressure then tends to force the uterus down in the vagina.

**Broad Ligaments.** The bases of the broad ligaments are also part of the endopelvic fas-

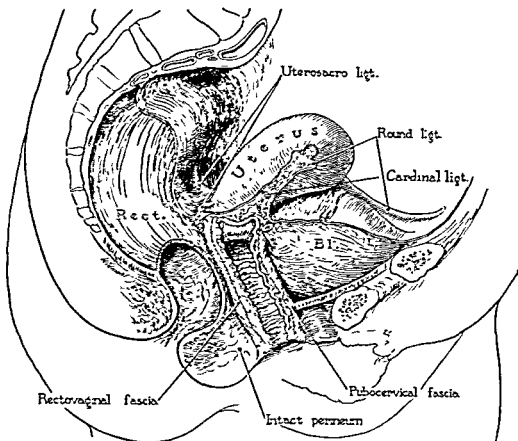


FIG. 59. Indicating normal supports of uterus.



cia and play an extremely important role in maintaining the uterus at its normal level. These cardinal ligaments, attached to the sides of the intra-abdominal portion of the uterine cervix, fan out laterally as they approach the sides of the pelvis to which they are attached. One must assume a congenital factor of weakness of these ligaments in some cases of prolapse, for occasionally one sees them greatly attenuated in women who have neither done much physical work nor borne any children. However, in most cases in which the cardinal ligaments fail, childbearing and physical work play a major role. The softening effect of the pregnancy hormones, the weight of the pregnant uterus and the increased intra-abdominal pressure of hard work all tend to stretch the cardinal ligaments and permit the uterus to drop to a permanently lower level.

**Fascial Sheath.** The normal nulliparous vagina is maintained in position as a semi-

rigid structure by a strong fascial sheath which encases the mucosa. Anteriorly, this pubovesicocervical fascia lies between the bladder and the vagina and stretches from its origin at the symphysis pubis beneath the bladder to be inserted into the anterior wall of the cervix. The upper part of this fascia is easily seen when the bladder is dissected down in performing an abdominal total hysterectomy. Posteriorly, similar rectovaginal fascia separates the vagina from the muscular wall of the rectum, giving support to the vaginal tube and preventing the anterior rectal wall from bulging into the vagina. When these fascial structures are torn and stretched by childbirth, the vaginal wall becomes redundant and flabby; rectocele and cystocele develop. The weight of the uterus, especially if it is retroverted, aggravates the sagging of the vagina, and when prolapsus becomes complete the vagina may become entirely everted.

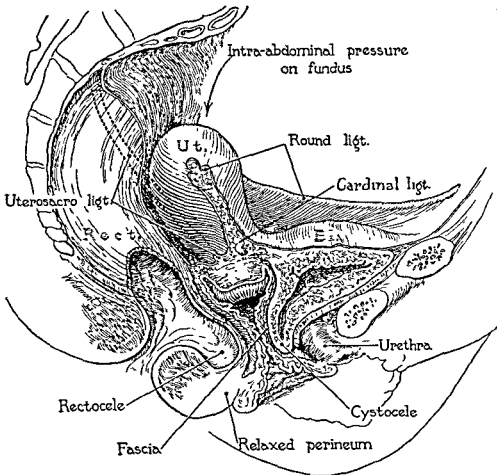


FIG. 60. Indicating how failure of normal supports permits descent of uterus, as well as cystocele and rectocele formation.

**Muscular Floor of the Pelvis.** Finally, there is the muscular floor of the pelvis to be considered. This forms the foundation upon which the vaginal tube rests, and hence the foundation upon which the uterus rests ultimately. Tearing and separation of the pubococcygeal fibers of the levator muscles weaken this floor and widen the aperture through which the vagina and eventually the uterus may descend. For a better understanding of the factors concerned in prolapse of the uterus the reader is referred to the diagrams shown in Figures 59 and 60.

All of these structures play a part in holding the uterus in its normal position; some or all of them are utilized in the various operations described below, designed to restore support to the pelvic structures.

### THE MANCHESTER (DONALD OR FOTHERGILL) OPERATION

In 1888 Donald, of Manchester, began treating prolapsus uteri by the combination of anterior and posterior colporrhaphy and amputation of the cervix. For over half a century this operation has been performed continuously in Manchester by a number of gynecologists upon "all patients with prolapsus uteri, irrespective of age, social position or parity." Before Fothergill modified the operation, the procedure was to amputate the cervix by the Schröder method and to follow this by an anterior colporrhaphy. Fothergill made the incision for the anterior repair triangular in shape with the base at the cervix and then carried the incision around the cervix to perform the amputation. This exposed the bases of the broad ligaments to better advantage than by the method previously employed and facilitated the approximation of these supporting structures in front of the cervix. This operation, with slight variation, has been done by different members of the Manchester staff since 1888. Descriptions of its technic, which have appeared in the literature, vary as to detail. The operation, as done in this clinic, is described in this volume. The fundamental principles underlying the procedure are exactly as in the operation described by Shaw from the Manchester Clinic in 1933, but certain details differ slightly.

In 1933 Shaw reported on 549 patients who had been treated for prolapse by this method. His reports were obtained by questionnaire; no attempt was made to describe anatomic results. Ninety-six per cent were reported as completely cured, a figure which compares favorably with the best reports on any method of treating prolapse. In spite of this report we are not convinced that the operation is the one of choice in "all patients with prolapsus uteri, irrespective of age, social position or parity." It is our opinion that the Manchester operation is a satisfactory procedure when (1) there is a cystocele associated with a prolapse of first degree (certainly not over second degree); (2) childbearing need no longer be considered; and (3) when the uterus is not in marked retroposition or when the retrodisplaced uterus is a small atrophic structure and not contributory to the patient's symptoms. The operation is particularly satisfactory under the above conditions when much of the apparent prolapse is due to cervical elongation.

We believe that there is a definite objection to the operation when future pregnancy is likely, because of the amputation of the cervix. Leonard found that, following cervical amputation, the incidence of sterility was abnormally high; premature delivery between the 6th and the 8th months increased, and cervical dystocia was common. Shaw's own results would seem to condemn the operation during the childbearing period. Only 27 of the 549 women of his reported group subsequently had children. Since admittedly the operation was done on women "regardless of age," there must have been a goodly proportion of young women in the group. The small number who subsequently bore children appears to indicate a high incidence of either sterility or abortion. Shaw relates further that of the 27 who had children "only 5 showed any signs of recurrence." The recurrence of the prolapse in 18.5 per cent of the women who bore children would seem to us to contraindicate the operation in women in whom future pregnancy is probable. Hunter, a recent member of the University of Manchester staff, regards the operation as contraindicated when further childbearing is desired.

We must confess that we never have used this operation for complete procidentia, be-

cause it scarcely seems logical that a simple anterior colporrhaphy, with suturing of the cardinal ligaments in front of the cervix coupled with cervical amputation and posterior colporrhaphy, can support the completely prolapsed uterus. In our opinion, other methods described in this chapter will give stronger support.

Mechanically, there is little to support the view that the Manchester operation will hold a third-degree retroverted uterus in ante-position, and our experience with the operation bears out this skepticism. When the retroversion is slight, plication of the ligaments anterior to the cervix may hold the fundus forward, but when the retroversion is extreme, and especially when there is a marked degree of retroflexion of a large boggy uterus, the retroversion will not be cured by this procedure alone.

Except for the Le Fort operation, the Manchester operation has one advantage over most of the other vaginal procedures for cure of uterine prolapse. It is simpler, and usually can be done in less time and with less shock. Hence, in elderly or in otherwise frail women, in some instances it may be used with great advantage.

#### TECHNIC

The patient is placed on the table in the lithotomy position and cleaned up for operation with the usual technic. Dilatation and curettage are done for two reasons: (1) a dilatation of the cervical canal is desirable at a later stage of the operation when the posterior flap of mucosa is drawn into the cervical canal; (2) since the body of the uterus is to be saved, it is well to make certain that no malignancy exists. If the endometrium obtained looks at all suspicious of malignancy grossly, it is best to proceed no further with the operation until microscopic examination of the curettings has been made.

If the labia minora are long enough to interfere with the operation they may be stitched back laterally.

Traction is made on the cervix by a Jacobs clamp, and an incision is made through the anterior vaginal mucosa. This incision may be made in the mid-line from cervix to urethral meatus, dissecting beneath the mucosa with the curved scissors as illustrated in

the operation for cystocele, or a more-or-less triangular piece of vaginal mucosa may be excised as practiced by Shaw of the Manchester Clinic. Our usual practice is to make a mid-line incision connecting with a transverse incision at the cervix, excising the excess of mucosa later. In the illustrations the operation is done through this inverted-T incision, but the initial incision is not shown, since it is identical with that illustrated in the cystocele operation.

The flaps of vaginal mucosa are dissected laterally, and the bladder is dissected up from its attachment to the cervix. In the beginning the separation of the bladder from the cervix must be done by sharp dissection, but usually after a few "snips" with the scissors the bladder may be freed from the uterus by blunt dissection with the finger up to the vesico-uterine reflexion of the peritoneum. The bladder is held up anteriorly with a thin-bladed retractor as illustrated in Figure 61 A.

The transverse cervical incision, through the mucosa is then carried posteriorly, completely circumcising the cervix. The posterior flap of mucosa is dissected free from the cervix until a flap has been mobilized sufficiently ample to cover easily the posterior lip of the shortened cervix. Having freed the mucosa about the cervix both anteriorly and posteriorly, the base of the broad ligament is exposed in the paracervical region. The tissue in this region is of variable thickness. If there is great elongation of the cervix the structure may be attenuated markedly. Contained in it is the cervical branch of the uterine vessels. The fibrous tissue is clamped, en masse, with an Ochsner clamp parallel with and close to the cervix, cut and tied (Fig. 61 A). When the cervix is markedly elongated so that a great length must be amputated, two tandem bites of the clamp may be necessary. This is repeated on the opposite side. To sever further the cervical blood supply, a suture ligature of No. 1 chromic catgut is placed through the side of the cervix bilaterally, just above the point of intended amputation.

The cervix is amputated as indicated by the dotted line in Figure 61 A, and the shortened posterior lip is covered with the posterior flap of mucosa, using a mattress suture of No. 1 chromic catgut. The exact

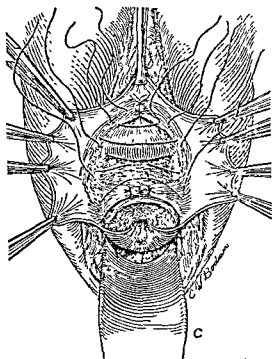
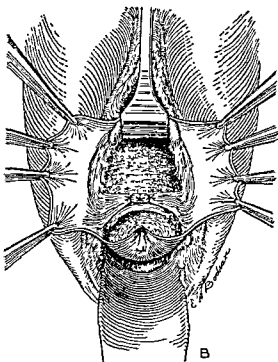
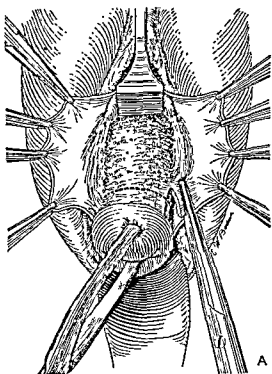


FIG. 61. Manchester operation for uterine prolapse and cystocele. (A) The bladder has been dissected up from the cervix. The incision has been carried through the mucosa around the cervix, and the mucosa dissected free from the cervix. The bases of the broad ligaments are thus exposed. The left has been clamped and cut. The dotted line indicates where the cervix is to be amputated. (B) The cervix has been amputated, and the posterior lip has been covered with a flap of mucosa. The bases of the broad ligaments have been sutured to the anterior surface of the cervix. (C) Pubovesicocervical fascia is being approximated in the mid-line beneath the urethra, the base of the bladder and the cervix. Note that the lower sutures bite into the anterior wall of the cervix.

method of placing this suture is indicated on page 387 under "cervical amputation."

The ligated broad ligament bases are then drawn together and sutured in front of the

shortened cervix. It is well to bite into the anterior cervical wall with this suture in order to fix the ligaments in this position (Fig. 61 B).

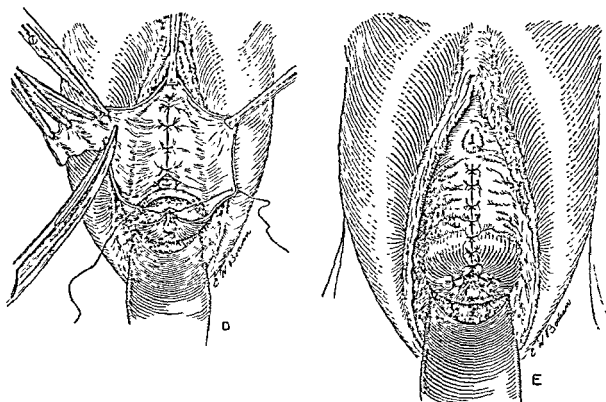


FIG. 61 (Continued) Manchester operation for uterine prolapse and cystocele. (D) The fascia approximation has been completed. Excess vaginal mucosa is being excised. The first suture has been placed through flaps of the mucosa, biting into the cut surface of the shortened cervical lip to cover it with mucosa. (E) The operation on the anterior wall has been completed. It is to be followed by a posterior colporrhaphy.

Beginning beneath the urethra, the pubo-cervical fascia, which has been freed from the lateral mucosa flaps, is approximated in the mid-line with interrupted mattress sutures of No. 0 chromic catgut as indicated in Figure 61 C. This fascia covers over, successively, the urethra, the base of the bladder, the lower portion of the uterus and finally at least part of the broad ligaments that have been approximated previously in the mid-line. The lower sutures are made to bite into the anterior surface of the lower portion of the body of the uterus.

Figure 61 D shows the fascia approximated and the excess of vaginal mucosa being excised. The mucosa is then sutured in the mid-line with interrupted sutures of No. 0 chromic catgut. It is usually advantageous to suture the cervical end of the mucosal incision first. In doing this, a bite is taken into the anterior lip of the shortened cervix, as illustrated in Figure 61 D. One or two

lateral sutures are necessary to cover the cervix completely. Figure 61 E shows the completed operation.

Posterior colporrhaphy is then done with appropriate technic to cure the relaxed outlet, the rectocele, and/or the enterocele as indicated in the individual case.

#### THE WATKINS TRANSPOSITION OPERATION

This operation for cystocele and uterine prolapse was first done by Thomas J. Watkins in 1898 and was reported by him the following year. Freund was the first (1895) to deliver the uterus into the vaginal canal for the cure of uterine prolapse and cystocele. He delivered the uterus through an incision in the posterior vaginal fornix and sutured the anterior-vaginal wall to the posterior surface of the uterus, and the posterior vaginal wall to the anterior surface of the uterus. He then made an opening through the fundus of

the uterus for drainage. The fundus was left uncovered in the vagina. Fritsch modified Freund's operation by denuding an area on the anterior vaginal wall and suturing the posterior wall of the uterus to it, after the uterus had been delivered anteriorly. A T-shaped incision was made on the posterior vaginal wall, and two flaps of mucosa were dissected free. These flaps of mucosa were reflected over the fundus of the uterus and sutured there. Wertheim modified Fritsch's procedure by delivering the uterus through an incision in front of the cervix and scarifying the anterior wall of the vagina and the posterior wall of the uterus. Then the two scarified areas were sutured together with catgut. Schauta and Wertheim later reported an operation very similar to that described by Watkins, and frequently the Watkins operation has been called the Wertheim operation. As a matter of historical record, Watkins published his operation in 1899, before Wertheim's report of his modification of Freund's operation and 3 years before Wertheim's assistant, Bucura, reported on the results of the Wertheim-Freund operation. Hence, we shall refer to the operation under consideration as the Watkins transposition operation. It is generally known throughout this country as the "interposition operation," but Watkins preferred the term "transposition," since the uterus and the bladder are transposed.

This operation was formerly used extensively in our clinic for uterine prolapse and cystocele, and in most instances the results were very satisfactory. Our results were reviewed independently by Shaw, Brady and Everett for 3 different eras. Their combined figures give evidence of recurrence in 3.5 per cent of the cases. In contrast with this, there was 30 per cent of unsatisfactory results when vaginal panhysterectomy was done for prolapse. Everett could find no evidence for the belief that an advanced degree of prolapse is a contraindication to the transposition operation, for in his series all cases with complete procidentia were cured. Through extensive personal experience with this operation we have had only 2 cases in which the results were not satisfactory. Failure to amputate the cervix, which seemed to be un-

necessary at the time of the operation, was the cause of the unsatisfactory results in these 2 instances. Subsequently, the cervix became elongated and protruded. Since this experience, we have routinely amputated the cervix, even though it has not appeared elongated, and the results have been remarkably and uniformly successful. We have found the operation especially useful when a very large cystocele is present, and when the uterus is of sufficient size to serve as an adequate plug in supporting the bladder. When the uterus is an extremely small postmenopausal structure and the cystocele is large, sometimes one may bring the pubovesical-cervical fascia completely together in the mid-line in front of the small uterus or perform a vaginal hysterectomy or a Spalding-Richardson operation. As performed by most surgeons, the transposition operation is a lesser procedure than the vaginal extirpation of the uterus and, hence, less shocking to the aged or to the patient who is otherwise a poor surgical risk.

In former years there was genuine enthusiasm for this operation in our clinic. It is still done by some of the senior men, but it must be admitted that it has definite limitations and contraindications, and our younger surgeons rarely do it.

Obviously, pregnancy should not follow this operation. If it is done on a woman in whom pregnancy is possible, the tubes should be cut and ligated. Aside from the question of pregnancy, we dislike the operation on young women because it fixes the anterior vaginal wall to the uterus, and the vagina is less pliable than after a Spalding-Richardson composite operation or a vaginal hysterectomy. The anterior vaginal wall is also shortened appreciably in some instances, and the resultant vagina is less satisfactory as a functioning organ. Disease of the corpus uteri is a definite contraindication to the operation, although often small myomata can be excised and the uterus transposed quite satisfactorily. Even the possibility of subsequent disease is a disadvantage in young women who have many years ahead of them during which myomata or functional bleeding may develop. The operation always should be preceded by a diagnostic curettage in order

to exclude the possibility of interposing a corpus containing endometrial carcinoma. There always remains the possibility of subsequent development of a corpus carcinoma, and this must be considered a point against the operation. Fortunately, such a possibility is rare. A uterus subject to functional bleeding should not be transposed. For technical reasons there are times when a large fibrotic organ cannot be interposed successfully. In short, we consider the interposition operation a satisfactory procedure for the cure of prolapse of the uterus up to third degree in women approaching or past the menopause, when the uterus is healthy, bearing in mind the contraindications mentioned above. It is of special value when there is an accompanying large cystocele and a uterus that has not become too atrophic or too large to serve as an effective support for the base of the bladder. We also prefer it to the vaginal hysterectomy or the Spalding-Richardson composite operation when the general condition of the patient dictates a shorter operation. However, often an equally good result can be obtained by the use of a still simpler and shorter operation under such circumstances, namely the Manchester operation. Because we believe there is the occasional woman with a large cystocele and moderate descensus, with a uterus of exactly the proper size and poor pubocervical fascia in which the transposition operation serves very well, we have included it in this chapter.

### TECHNIC

The patient is put in the lithotomy position, and a posterior retractor is placed in the vagina. The anterior lip of the cervix is grasped with a Jacobs clamp, and the cervix is drawn toward the outlet.

An inverted T-shaped incision is made. Customarily, we first make the cross bar of the T through the vaginal mucosa at its reflexion onto the anterior lip of the cervix. Then, using a curved scissors, a tunnel is made beneath the vaginal mucosa in the midline by alternately opening and closing the scissors and keeping the curved end of the scissors directed toward the mucosa. After tunneling for a few centimeters, the mucosa is cut in the mid-line, the tunneling is con-

tinued, and the mucosa is cut again. This is continued until the urethral meatus is reached, as indicated in the portrayal of the cystocele operation on pages 172 to 174.

The mucosa flaps are dissected laterally, thus exposing the base of the bladder. The attachment of the bladder to the cervix is then cut, and the bladder is pushed upward. Soon a plane of free cleavage is encountered, and the finger can be easily pushed up to the vesico-uterine fold of the peritoneum (Fig. 62 A).

Next, a narrow retractor is placed in this dissected space, and the bladder is held upward. This usually exposes the under surface of the peritoneum of the vesico-uterine fold. If the peritoneum is not seen readily, the uterus may be pulled down by placing figure-of-eight sutures in the anterior surface of the lower portion of the uterus and making traction. When the peritoneum is visualized, it is incised. It is a good plan to place a catgut suture on the peritoneal edge for later identification. Following this, the narrow retractor is introduced into the peritoneal cavity, and the anterior surface of the uterus is exposed.

Amputation of the cervix is usually best done at this stage of the operation, because getting rid of the cervix often facilitates delivering the fundus. The technic of cervical amputation used here is similar to that described on page 385 in Figure 192; or, if a high amputation is desirable, the technic described on page 387 in Figure 193 is used. Only the posterior lip of the shortened cervix is covered over with a flap of mucosa at this stage (Fig. 62 B). The anterior lip is covered at the final stage of the operation.

Next, the fundus is delivered through the peritoneal opening. We have found the Lahey thyroid clamps to be especially well adapted for this. They bite into the uterus with the several teeth; hence, they are not as apt to tear out as is the ordinary tenaculum. When these clamps are not available, it is our habit to deliver the uterus by successive figure-of-eight sutures in a hand-over-hand manner as shown in Figure 62 B.

If the operation is done on a premenopausal woman, cornual resection of the tubes should be done for sterilization as indicated

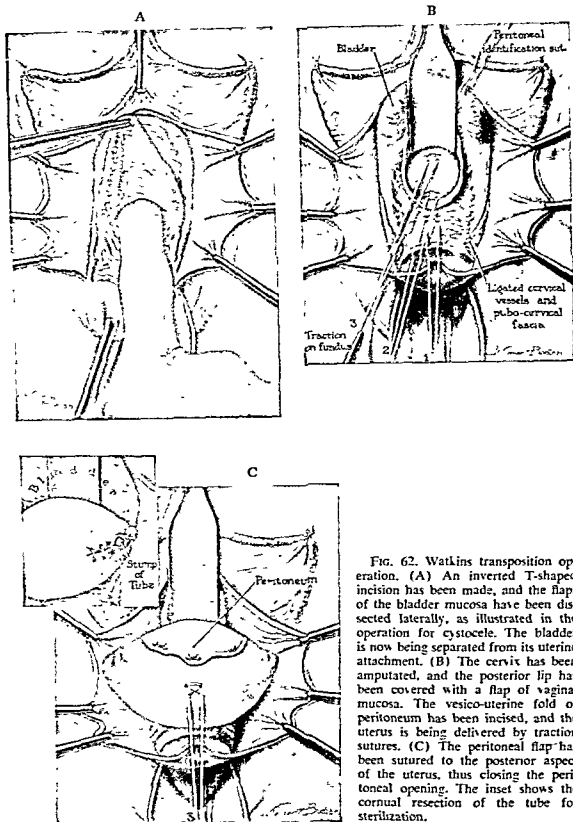
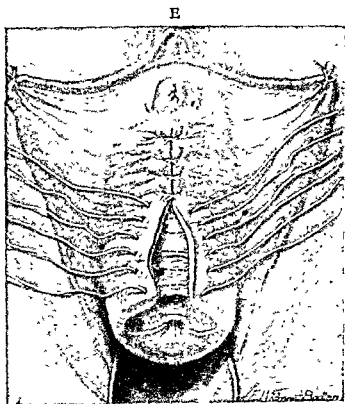


FIG. 62. Watkins transposition operation. (A) An inverted T-shaped incision has been made, and the flaps of the bladder mucosa have been dissected laterally, as illustrated in the operation for cystocele. The bladder is now being separated from its uterine attachment. (B) The cervix has been amputated, and the posterior lip has been covered with a flap of vaginal mucosa. The vesico-uterine fold of peritoneum has been incised, and the uterus is being delivered by traction sutures. (C) The peritoneal flap has been sutured to the posterior aspect of the uterus, thus closing the peritoneal opening. The inset shows the cornual resection of the tube for sterilization.



FIG. 62 (Continued). Watkins transposition operation. (D) The inset shows the fundus being sutured beneath the pubic rami. The larger picture shows the fundus sutured in place. An additional mattress suture has been placed in the mid-line to prevent prolapse of the urethra or the trigone. Excess vaginal mucosa is being trimmed off. (E) Closure of the vaginal incision with interrupted sutures. With each suture a bit of subjacent tissue is picked up to obliterate dead space.



in the inset in Figure 62 C. The tube is ligated with No. 0 chromic catgut and is cut about a centimeter from the uterine cornu. It is excised at the cornu, and the cornual wound is closed with figure-of-eight sutures of No. 0 chromic catgut.

The opening in the peritoneal cavity is closed by using a few interrupted sutures of No. 0 chromic catgut to attach the peritoneum to the posterior surface of the delivered uterus (Fig. 62 C).

The fundus of the uterus is then sutured beneath the pubic rami, as indicated in the inset in Figure 62 D, using No. 1 chromic catgut. A single ample bite of tissue into each uterine cornu and into the tissues beneath the pubic rami completes this fixation of the uterus. It is not necessary to carry the subpubic sutures into the periosteum of the pubis, as suggested by some surgeons. The uterus can only heal to the tissues with which

it is in contact; hence, nothing is to be gained by including the periosteum in the suture. In order to prevent the trigone from slipping out from behind the fundus, it is our custom to place a mattress suture through the fundus and to carry it out through the vaginal mucosa just behind the urethral meatus, as in Figure 62 D.

The excess of vaginal mucosa is excised as is shown by the dotted line in Figure 62 D. Closure of the anterior vaginal incision is done with interrupted sutures of No. 0 chromic catgut. Each of these sutures picks up a bit of the subjacent uterus to obliterate dead space (Fig. 62 E). The final one of these sutures covers the anterior lip of the shortened cervix. The redundant mucosal edges laterally in the region of the cervix are approximated with figure-of-eight sutures of No. 0 chromic catgut.

The sagittal section of the completed op-

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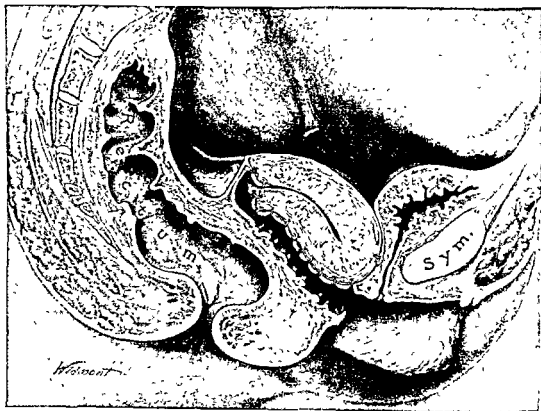


FIG. 62 (Continued). Watkins transposition operation. (F) Shows transposed uterus fixed in its new position. Increased intra-abdominal pressure serves only to press the fundus more snugly against the urethra, which is supported by the fundus.

eration (Fig. 62 F) shows the position of the uterus at the conclusion of the operation. From this diagram one sees how impossible it is for the cystocele to recur when the uterus is adherent to the anterior vaginal wall. It is also apparent that the direction of the axis of the uterus has been altered so that it can no longer descend into the vagina as a plunger in a cylinder.

## THE VAGINAL PANYSTERECTOMY

Although vaginal panhysterectomy is an extremely useful operation in selected cases, we do not believe that it is the final answer to all cases of prolapse. We realize that this statement is not in agreement with the views of many excellent gynecologists, such as Heaney, Allen, Edwards, Aldridge and the Mayo group. However, the experience of this clinic has not been identical with theirs, and our opinion is based chiefly on our own observations. In 1935 Everett made a follow-up study of the interposition operation and the vaginal hysterectomy operations. Prior to that date most cases of prolapse were treated in our clinic by those two methods. The results with the interposition operation were surprisingly good from the standpoint of curing the prolapse. The shortcomings and the limitation of the operation have been discussed under that heading. Everett found that in 30 per cent of the cases in which vaginal hysterectomy had been done for prolapse the anatomic results were not good. This does not mean that in 30 per cent of the cases the clinical result was unsatisfactory but that the perfect anatomic result which was desired was not attained. This appears to be an inordinately large percentage, and it is, when compared with most figures given in the literature on the results of vaginal hysterectomy. However, it should be pointed out that in Everett's cases, the operation was done on women with marked prolapse and in many with complete procidentia.

It must be remembered that in those clinics from which much better results are reported, the operation is done in a great percentage of the instances for conditions other than prolapse. Therefore, it is to be expected that the ultimate anatomic results would be better so far as vaginal support is concerned. Nevertheless, Danforth, who was an ardent advo-

cate of vaginal hysterectomy, reported unsatisfactory results in 12.5 per cent of those cases in which the operation was done for prolapse. When prolapse of the vagina does occur following vaginal hysterectomy, it should be remembered that the condition is one of the most difficult to cure with the preservation of a functioning vagina. We reserve the vaginal hysterectomy in the cure of marked prolapse for those cases when disease of the uterus makes its removal desirable, such as small myomata, functional bleeding and unexplained postmenopausal bleeding. In spite of our skepticism for the operation as a cure-all for uterine prolapse, we are most enthusiastic about the operation in properly selected cases for some other conditions. Our indications for vaginal hysterectomy for other reasons are discussed in the chapter on myomata.

## HEANEY TECHNIC

The performance of a vaginal hysterectomy is facilitated by the use of a proper operating table. When the patient is in the lithotomy position, the hips should come just to the edge of the table so that the hanging speculum may swing free. If the patient is down too far, the axis of the vagina points upward, and vision is obscured. Narrow delicate instruments also contribute to ease in operating vaginally. Heavy cumbersome tools may make access to the uterus through a virginal vagina impossible. In addition, a well-focused spotlight is essential.

After the patient has been anesthetized and placed in proper position, the vulva and the perineum are thoroughly washed, as is also the vagina, with soap and water; the bladder is completely emptied with a catheter and the operative field is swabbed with dilute tincture of iodine or Lugol's solution, the excess of which is removed by alcohol.

The labia, when long, should be stitched back out of the way (Fig. 63 A). If the introitus is too tight, a small mid-line episiotomy will overcome the difficulty. A narrow vaginal fornix is a more serious obstacle to easy operating.

The cervix is seized with a bullet forceps and is pulled strongly into view. If it is badly eroded or cystic, it should be well sterilized with a cautery. Two cubic centimeters of obstetrical pituitary extract are injected into the paracervical tissues or vaginal walls (Fig. 63 A). This will reduce the bleeding to a minimum. A transverse incision is made through the mucosa of the vaginal wall just above the portio but below

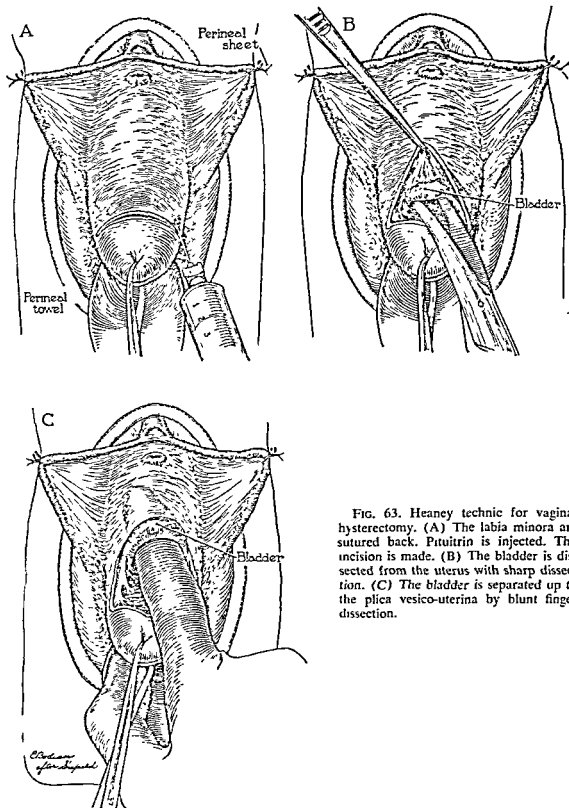


FIG. 63. Heaney technic for vaginal hysterectomy. (A) The labia minora are sutured back. Pituitrin is injected. The incision is made. (B) The bladder is dissected from the uterus with sharp dissection. (C) The bladder is separated up to the plica vesico-uterina by blunt finger dissection.

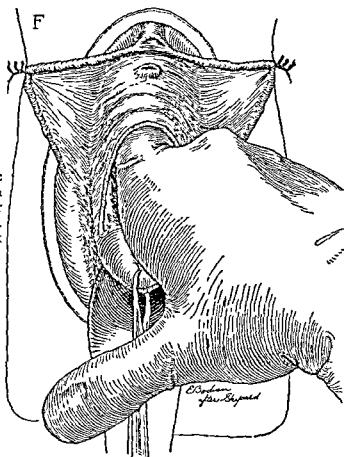
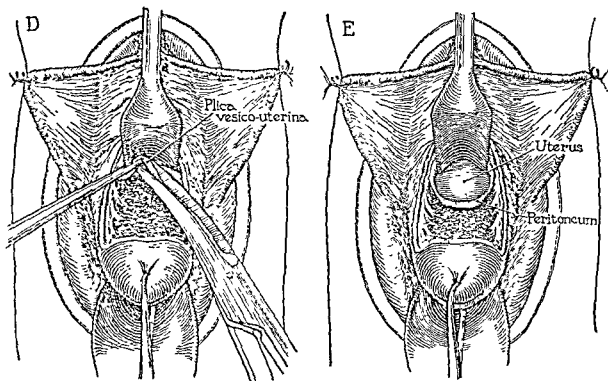


FIG. 63 (Continued). Heaney technic for vaginal hysterectomy. (D) The plica vesico-uterina is incised. (E) A retractor is introduced into the peritoneal cavity. (F) The pelvis is explored with the index finger.

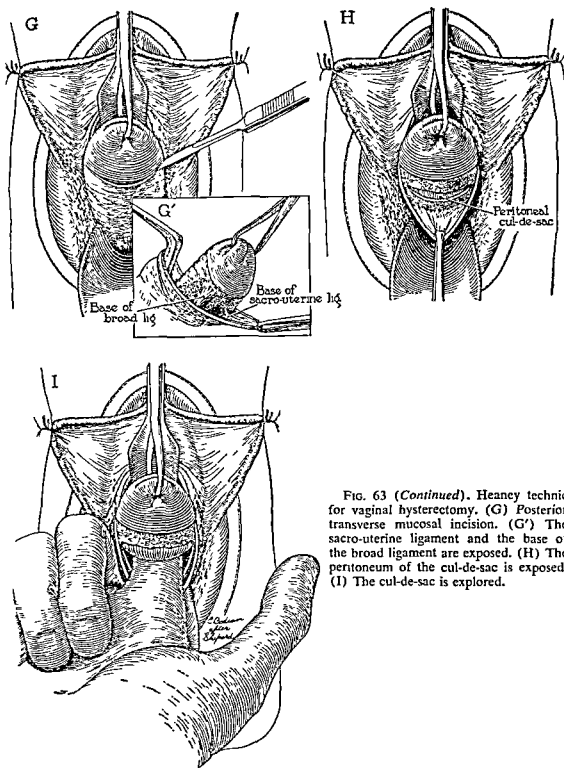


FIG. 63 (Continued). Heaney technic for vaginal hysterectomy. (G) Posterior transverse mucosal incision. (G') The sacro-uterine ligament and the base of the broad ligament are exposed. (H) The peritoneum of the cul-de-sac is exposed. (I) The cul-de-sac is explored.

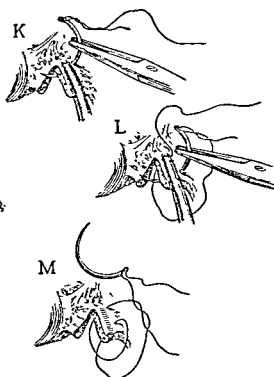
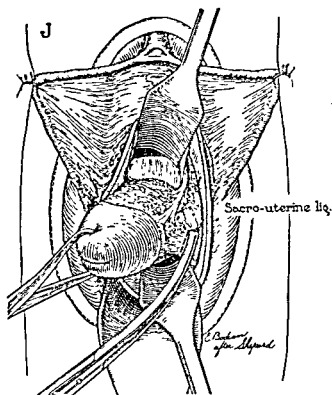
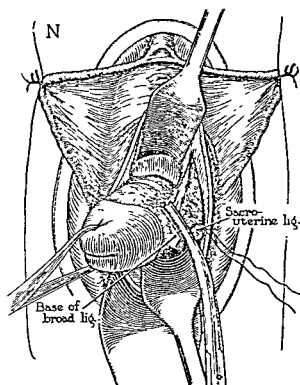


FIG. 63 (Continued). Heaney technic for vaginal hysterectomy. (J) The left sacro-uterine ligament is clamped. To be cut at dotted line. (K, L, M) Transfixion of the sacro-uterine ligament. (N) The base of the broad ligament with the uterine vessels is clamped. To be cut at dotted line.



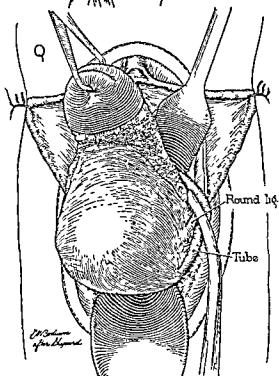
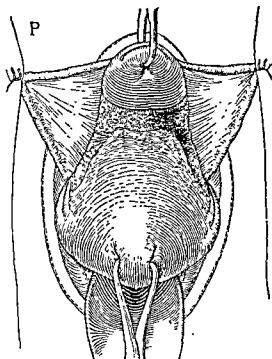
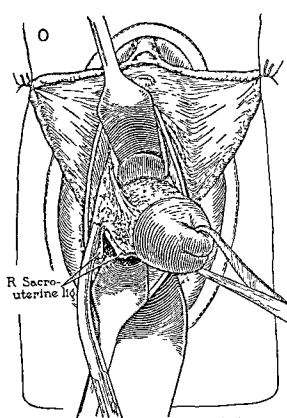


FIG. 63 (Continued). Heaney technic for vaginal hysterectomy. (O) The right sacro-uterine is clamped and cut. (P) The fundus of the uterus is delivered. (Q) The upper portion of the broad ligament, including the tube, the ovarian ligament and the round ligament, is clamped.



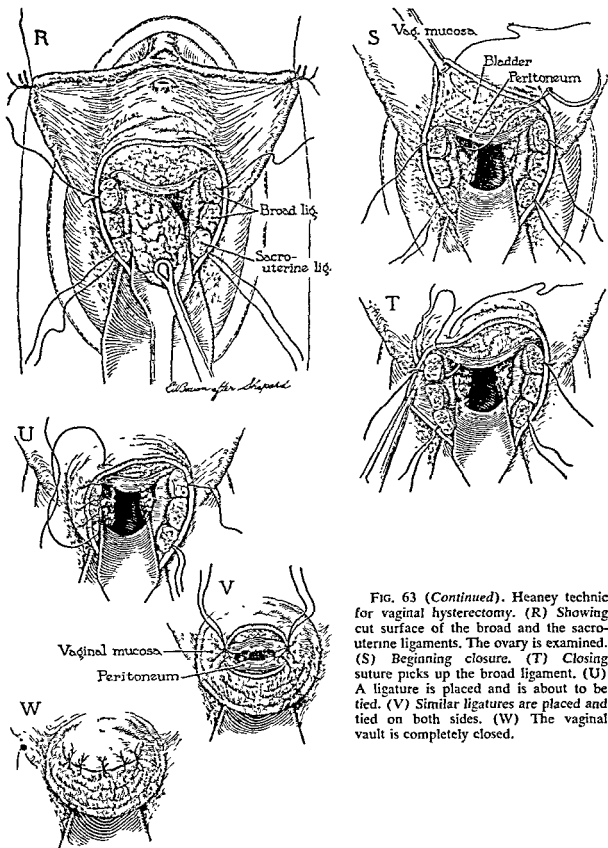


FIG. 63 (Continued). Heaney technic for vaginal hysterectomy. (R) Showing cut surface of the broad and the sacro-uterine ligaments. The ovary is examined. (S) Beginning closure. (T) Closing suture picks up the broad ligament. (U) A ligature is placed and is about to be tied. (V) Similar ligatures are placed and tied on both sides. (W) The vaginal vault is completely closed.

the attachment of the bladder (Fig. 63 A). A sound passed into the bladder will demonstrate how low the bladder lies.

If a cystocele is to be corrected, the vaginal wall is carefully freed from the bladder in the center of this incision. Then curved scissors are introduced between the vaginal wall and bladder with the curve forward. The vaginal wall is easily separated from the bladder by shoving the closed scissors carefully forward toward the urethra, then spreading the blades, shoving forward again with closed blades and opening again until under the urethra. The flaps are now freed laterally from the bladder, partly by blunt dissection with gauze and by the scissors until as much is loosened as is to be removed. The redundant mucosa is now cut away, and all bleeding points accurately controlled. If the urethra is to be tightened, it is done at this time and the mucosa over the urethra sutured with interrupted No. 2 ten-day chromic catgut which is used throughout the entire operation. The rest of the anterior colporrhaphy is completed after the removal of the uterus.

The bladder is now freed from the anterior surface of the uterus up to the plica vesico-uterina (Fig. 63 B, C). Usually this can be accomplished by blunt dissection with gauze. If a previous plastic operation has been performed in this region, adhesions may make blunt dissection impossible, and sharp dissection may become necessary. One must be careful then that the dissection is carried out rather toward the uterus than toward the bladder. If the bladder is entered, great care must be used in loosening the rest of the bladder from its attachment so as not to widen the opening. As soon as the bladder is loosened, the hole in the bladder is repaired by interrupted No. 0 chromic sutures through the bladder mucosa, followed by a line of similar sutures through the muscularies of the bladder.

At the completion of the operation, an indwelling rubber catheter is to be inserted; this catheter is of the umbrella type if a hole in the bladder was repaired, or a hollow two-wing Malecot type if a urethroplastic operation was done. The umbrella type remains in the bladder with less discomfort and rarely slips out, but its removal may undo the urethroplastic repair; while the Malecot may be removed by stretching out the head by the use of a sound. While separating the bladder from the anterior wall of the uterus it should also be separated at its urethral attachments for about an inch on each side.

The free peritoneal fold in front is now

looked for, incised (Fig. 63 D) and a narrow-bladed retractor inserted into the peritoneal cavity to hold the bladder and the ureters forward (Fig. 63 E). Occasionally, the uterus remains too high to make the plica vesico-uterina readily accessible, or a tumor low down on the cervix interferes at this point. If the bladder cannot be pushed up easily enough and delay is encountered in getting in to the anterior cul-de-sac, puttering may cause damage; in such an event one should cease work here and attempt to enter the posterior pouch. Pull the cervix strongly forward and make a transverse incision through the vaginal mucosa, at the height of the posterior fornix (Fig. 63 G), joining the anterior to the posterior incisions by cutting on each side of the cervix through the mucosa (Fig. 63 G). Do not plunge boldly into the cul-de-sac; the rectum may be injured. After cutting through the mucosa, push it back with the finger or by sharp dissection until the peritoneum is seen (Fig. 63 H). Then incise it and introduce a narrow right-angled retractor similar to the one used in front (Fig. 63 J). Occasionally, difficulty is met in entering the posterior space. Persistence at this stage adds to the chance of injury to the rectum.

Pushing back the mucosa in the attempt to see the peritoneum exposes each sacro-uterine ligament. These should now be seized separately and extraperitoneally by a narrow, curved, grooved clamp with distal teeth similar to a gallbladder clamp. The ligament is then cut on the uterine side, and the clamp is replaced by a fixation ligature (Fig. 63 J, K, L, M). Loosening of the sacro-uterines usually allows the uterus to descend sufficiently so that both cul-de-sacs, previously not accessible, may now be entered.

Having now placed a retractor in both the anterior and the posterior cul-de-sacs, they are held as widely apart as possible and to the left side of the patient so as to expose the left broad ligament. The left sacro-uterine ligament having been cut and ligated with catgut, both strands are held by a hemostat and cut long so that they may be identified later as holding the sacro-uterine ligament. The left uterine vessels can now be seen; they are similarly clamped, cut and replaced by a fixation suture of catgut (Fig. 63 N). In successive similar steps the broad ligament on the left is disposed of as high as possible. When further progress on the left cannot be made, the retractors are slipped to the right of the patient, and the right sacro-uterine is cut (Fig. 63 O) and ligated, and the double strand of catgut held in a hemostat. In

similar steps the uterine vessels are disposed of, and the right broad ligament is severed from the uterus as high as exposure allows.

It may happen that, after both uterine vessels are tied off, further progress in the vaginal removal of the uterus, for one cause or another, is impossible; in such an event the cervix is to be amputated, all bleeding points closed with interrupted catgut, the abdomen opened and the operation completed from above. This *impasse* need cause no apprehension. This combined operation has been performed many times to avoid contaminating the abdominal cavity from the infected cervix of a uterus which could not possibly be removed vaginally, or for other causes.

When the broad ligaments have been loosened high on each side, the uterine body, if not adherent and not too large, presents itself at the posterior opening where it may be hooked by a bullet forceps and partially pulled outside the pelvis (Fig. 63 P). The upper portion of the broad ligament, the uterine end of the tube, the suspensory ligament of the ovary and the round ligament on the left side can now all be identified. These are clamped (Fig. 63 Q) and cut, and the clamp is replaced by a ligature in the same way as the lower parts of the broad ligaments were treated, except that where the sacro-uterine ligament was left with two strands of catgut to identify it, the uppermost ligature on each broad ligament is left with a single strand (Fig. 63 R). After the left side of the uterus is freed, the right is loosened by a similar technic. The uterus is now inspected to see whether any pathologic processes exist that would make advisable the removal of otherwise normal appendages.

If the body of the uterus is too large to remove intact, cutting the cervix off may allow its easy delivery. If still too large, a morcellation must be done. This is made easier by keeping up continuous traction. No piece should be cut loose unless the uterus is held against possible retraction into the abdominal cavity. While doing a morcellation the upper portions of the broad ligaments should be found as quickly as possible for, after the communicating branches of the ovarian vessels are securely ligated, then the fear of excessive bleeding may be dismissed.

When the uterus has been removed a small pack is introduced, the tape of which is held by a hemostat, to hold back the intestines. The appendages are now inspected by drawing them into the operative field and are left or removed as seems advisable. It is rare that they cannot be inspected and examined or operated upon as

easily through the vaginal incision as by the abdominal route, opinions of inexperienced operators to the contrary notwithstanding. If a morcellation was done, the pelvis should be palpated for possible fibroid nodules that may have been shoved off and left behind.

The abdomen is now ready for closure. If an anterior repair was started, this is now completed, using interrupted catgut sutures so as not to shorten the anterior vaginal wall. When this is completed, closure proceeds as in a simple vaginal hysterectomy. A suture is passed through the right edge of the anterior mucosal incision, which takes several superficial bites of the denuded posterior wall of the bladder up to the peritoneal incision which the suture includes (Fig. 63 S). The narrow right-angle retractor is again inserted anteriorly so that the peritoneum is picked up in successive bites out to the round ligament and the tubo-ovarian stump, around which the suture is passed so as to ligate doubly the ovarian vessels. Then the suture is passed in bites from the upper to the lower part of the broad ligament, passing from the posterior surface of the broad ligament anteriorly so as to catch the peritoneal edges and thereby perform a peritoneal toilet (Fig. 63 T, U). When the suture reaches the level of the stump of the uterine vessels, it passes around it in such a way as to *feligate* these vessels. The suture then picks up the peritoneum of the posterior incision and is passed around the sacro-uterine ligament and then out into the posterior fornix. Then this suture is tied. It has doubly ligated all vessel stumps, attached the round and broad and sacro-uterine ligaments to the vaginal vault so as to hold up the vault of the vagina. In addition, it has performed the peritoneal toilet on the right side of the pelvis and has closed the right side of the vaginal incision.

A similar suture is started on the left side which duplicates exactly the steps described for the right side (Fig. 63 V). Before tying this second suture, the peritoneal pack is removed. Two or three interrupted sutures, which in turn pick up the anterior mucosal edge, the anterior peritoneum, the posterior peritoneal edge and the posterior mucosa, complete the operation (Fig. 63 W). Considerable bleeding occurs from the posterior flap and this incision is longer than the anterior so that these anteroposterior sutures usually take two or three bites of the posterior flap for each one in the anterior incision. This makes a smoother closure and controls the troublesome oozing from the posterior incision. If a tendency to prolapse exists, the sacro-uterine ligaments are sewn together before

closing the vaginal vault. The operation is completed by performing repair of the posterior pelvic floor, if advisable.

The patient is allowed out of bed on the seventh day, at which time perineal sutures and the retention catheter, if one was used, are also removed. If an indwelling catheter was used, the bladder should be tested once daily for retention of urine until it empties itself, in the same way as is done immediately after the operation when no indwelling catheter is used.\*

### THE SPALDING-RICHARDSON COMPOSITE OPERATION FOR UTERINE PROLAPSE AND ALLIED CONDITIONS

In 1937 Edward H. Richardson described an operation for uterine prolapse and associated conditions which has been used in this clinic with increasing frequency. Because of his dissatisfaction in some respects with the various current methods of curing uterine prolapse, Richardson devised this composite operation which utilizes principles and techniques of various procedures already in use. It consists essentially of cervical amputation, corpus removal at any level desired, the utilization of the isthmus portion of the uterus with its broad and uterosacral ligament attachments for interposition and finally the approximation in the mid-line of the pubocervical fascia beneath the urethra, the base of the bladder and the retained portion of the uterus.

The Richardson plan has as its objective:

(1) Riddance of the hypertrophied and diseased vaginal portion of the cervix. (2) Extirpation of the corpus uteri, together with the tubes and the ovaries if indicated. (3) Optional destruction or excision of any remaining cervical canal epithelium. (4) Minimal trauma and devitalization of structures, later to be utilized for reconstruction purposes. (5) Preservation of an assured and adequate blood supply to these several units. (6) Total ablation of associated enterocele through high obliteration of the cul-de-sac of Douglas. (7) Rational utilization of all supporting structures that experience has demonstrated to be helpful and dependable, namely: the pubocervical fascia; the basal portions of the broad ligaments with their extraordinarily strong cervical attachments; the utero-

sacral and the round ligaments; the fascia of the rectovaginal septum, as well as the muscles and the fascial layers of the pelvic floor and the perineum. (8) Re-establishment of a vagina of normal depth and caliber. (9) Restoration of normal anatomic relationship.

Richardson made no claim of originality for any of the multiple procedures used in his operation but stated that it was a composite operation that utilizes many operative steps already in use independently for various conditions in gynecologic surgery. Richardson's operation was presented before the American Gynecological Society in 1937 and was published in the *American Journal of Obstetrics and Gynecology* in November of that year. In 1942 Richard W. Te Linde and Edward H. Richardson, Jr., reported on the first 5 years' experience with this operation in the Johns Hopkins Clinic. On reading this article Ludwig Emge communicated with Richardson and called to his attention the fact that a similar operation had been described by Spalding in 1919. On reading Spalding's and Richardson's descriptions it is apparent that both authors described independently practically identical operations; both were activated by the shortcomings of the other operations in vogue for uterine prolapse; and both emphasized the same points in claiming superiority for their operations. Since the operation was worked out independently by the two authors, we suggest that it be called by their joint names. To those of us who use the operation frequently the remarkable fact is that an operation which has the merit of this one has escaped the general attention of gynecologists since Spalding's original article in 1919. Spalding's article is published under the title, "A Study of Frozen Sections of the Pelvis with Description of an Operation for Pelvic Prolapse." Perhaps the anatomic aspects of the paper eclipsed the surgical. Richardson's plan as carried out in this clinic is given later in some detail. Spalding's original technic is presented concisely in his own words as follows:

The fascia, overlying the cystocele, is exposed by a deep transverse incision across the cervix at the bladder junction. If this incision is superficial, the strong fascial plane will remain attached to the bladder. The vaginal wall with the fascia is separated from the bladder rather

\* Heaney, N. Sproat: Technic of vaginal hysterectomy, *Surg. Clin. N. Amer.* 22:73, 1942.

widely laterally. Before opening the peritoneum, the bladder is pushed up and the vaginal portion of the cervix removed as a cone according to the method of Hegar. A stitch is placed on either side of the cervix to ligate the vaginal branches of the uterine vessels, and the posterior half of the cervix is covered by a vaginal flap. The next step consists in opening the peritoneum and lifting the bladder away with a broad Doyen retractor. The fundus of the uterus is delivered as in an interposition operation; the round ligaments cut and tied with long catgut ligatures; the broad ligaments are clamped, close to the uterus, as far as the internal os and the fundus of the uterus removed by amputation. This exposes the sacro-uterine ligaments which are shortened if necessary. The stumps of the broad ligaments are sutured to the cervix and the cut round ligaments carried through the cervical canal and sutured to the inferior surface of the cut cervix. The mucous lining of the cervix is removed previous to this procedure. This pulls the cervix high and gives some support to the lateral walls of the bladder when removing the retractor. The fascia in the anterior vaginal wall is now dissected and overlapped as described by Neel and Rawls, and sutured to the stump of the cervix. This completely closes the bladder hernia. The mucosa is sutured by means of a few interrupted catgut sutures over the fascia and the anterior half of the cervix.\*

Since this operation is new and not in general use, our experience with it will be given in some detail. We have been able to get back for questioning and examination 33 women who were operated upon from 5 years to 6 months ago. There was no operative mortality. Since this report the number of these operations has increased to about 400, and the operative mortality is still zero. We attribute this in part to our careful selection of cases. It is generally a longer operative procedure than a vaginal hysterectomy and should not be attempted upon frail, elderly women. The average age of our cases was 44 years. The oldest patient was 64, and several were close to that age. The youngest patient in the series was 27. She had borne 3 children and had a second-degree prolapse with a large cystocele. Since she did not

desire more children, this operation seemed to be ideal for her, and it has proved to be so.

We have seen a few patients with moderate and one with severe operative shock. We have had one broad-ligament abscess which was opened, and the ultimate result of the operation is quite satisfactory. More recently, we have had a postoperative intra-abdominal hemorrhage which stopped spontaneously but became infected. The patient got well, and the ultimate operative result is excellent. There is the usual difficulty in voiding, postoperatively, as in any extensive vaginal operation. We have used repeated catheterization in some cases and retention catheters in others. We are not enthusiastic about either of these procedures but know of no better solution. The instillation of one ounce of 0.5 per cent aqueous Mercurchrome in the operating room, which we have used so successfully in our laparotomies in order to induce voiding, has little or no effect in any extensive vaginal plastic operations.

In connection with age, it is interesting to consider the operation from the standpoint of the preservation of menstruation. The average age of the patients operated upon by E. H. Richardson was 55 years, and few of his were premenopausal. However, we have had a tendency to extend the use of the operation to younger women, since one of the advantages of the operation is the use of the interposition principle without the risk of the subsequent development of myomas, functional bleeding or carcinomas as in the Watkins procedure. In the group of 18 cases operated upon by Te Linde and by the residents, the average age was 35 years. In 10 of the 18 cases, sufficient endometrium was permitted to remain to preserve some menstrual function. We feel that this is psychologically desirable in some young women and an advantage that obviously cannot be offered in vaginal hysterectomy. In all cases except one, the menstruation was very scanty, and it was painless in all except two who claimed some menstrual discomfort as before operation.

In the younger women the results as to function of the vagina are important. All of the 23 private cases stated that coitus was painless, but 4 of the 10 public-ward patients stated that they had slight or occasional dys-

\* Spalding, Alfred B.: A study of frozen sections of the pelvis with description of an operation for pelvic prolapse, *Surg., Gynec. & Obst.* 28:534-536, 1919.

pareunia. There was no evidence of vaginal constriction in any of these 4 cases, and indeed no organic basis for the complaint was found. We are inclined to consider the complaint as evidence of an unhappy marital status so frequently found in the overworked women of the dispensary economic class.

The most important question put to the returned patients was concerning their relief from the symptoms of which they complained before operation. All 23 private patients were completely relieved. Among the 10 public-ward patients there were 3 who refused to admit complete relief. In 2 of these there was a perfect anatomic result, but in the third there was a moderate cystocele with slight stress incontinence. Among these public-ward cases there were, of course, the overworked women with few social advantages, few intellectual resources and multiple complaints. Since the anatomic result was perfect in 2 of these 3 women, we feel that it is scarcely justifiable to attribute their incomplete relief to the operation, which in all except one instance anatomically corrected the vaginal herniation.

The results of a plastic operation which has for its object the restoration of broken-down supports should be considered from an anatomic point of view. Here again it seems desirable to divide the cases into the private group and the public-ward cases. Of the 23 private cases, the results were anatomically perfect except for a slight recurrent asymptomatic cystocele in one case and a slight urethrocele in another with slight stress incontinence. Among the 10 public-ward cases, there was one moderate recurrent cystocele with slight stress incontinence. There was also one case in which the vaginal vault descended slightly but this was entirely asymptomatic. Since this first follow-up study we have done a total of approximately 400 operations of this type. To the best of our knowledge there have been only 4 recurrences of the prolapse. All of these women were operated upon by residents who, perhaps with experience, will eventually attain the ultimate nearly perfect results such as have been attained by our visiting staff.

In view of the results of this operation, what can be said for or against it? It might be advantageous to consider our results by

comparing them with the criteria originally laid down by Richardson as the desired objective of any operation for uterine prolapse. The diseased portion of the cervix was removed in all cases, and there was no discharge from the preserved isthmic portion of the cervix. The portion of the cervix which is most commonly a potential site of carcinoma was removed. The corpus uteri, or the desired portion of it, was removed in each instance, practically eliminating it as a potential site of neoplasm and removing any disease that may have been present at the time of operation. The opportunity was presented at operation to remove the cervical canal mucosa, but we rarely felt this to be necessary, and our follow-up has not indicated that it should have been done. There was a minimal destruction of or interference with the blood supply of the units needed to support the vagina. Particularly, the bases of the broad ligaments and the uterosacral ligaments were not crushed as in vaginal hysterectomy and hence were better preserved for support of the vagina. All of the normal supporting structures were utilized to effect the complete repair, namely, the pubocervical fascia, the basal portion of the broad ligaments attached to the isthmic portion of the uterus, the uterosacral and the round ligaments, the fascia of the rectovaginal septum and the fascia and the muscles of the perineum. That these structures have supported the vagina well is shown by the fact that in only 1 case of the 33 was there a slight descent of the vaginal vault. The 2 cases of slight recurrent cystocele and 1 of slight urethrocele could have occurred with vaginal panhysterectomy, for in both operations cure of the condition is effected by the approximation of the pubocervical fascia. The Watkins operation which utilizes the whole corpus to support the bladder obviously has the advantage in this respect over any of the other procedures used for prolapse. Enterocoeles, if present, were eradicated in this series by dissection of the hernia sac formed by the elongated cul-de-sac, excising it and preventing its recurrence by approximating the uterosacral ligaments in the mid-line.

That the vagina was restored to its normal depth and caliber is shown by the examination of the organ in the follow-up study and by the report from all of the private

patients that coitus was comfortable. In the public-ward patients who complained of occasional or slight dyspareunia, there was no anatomic narrowing or shortening of the vagina. This has led us to extend the operation to younger women than were originally considered candidates for it by Richardson, provided that no further childbearing is considered advisable or is desired by the patient.

Observing that our results have been very satisfactory, we must admit at the same time that the operation is somewhat more complicated and usually more time-consuming than either the vaginal hysterectomy or the Watkins interposition operation. It is not our intention to advocate its routine use in all cases of prolapse. We believe that it is contraindicated in elderly feeble women who are poor operative risks. We have seen the good results obtained in our own clinic with the Watkins operation in many women, near or past the menopause, with large cystoceles and uteri of proper size. We believe that it is an excellent method of cure for cases falling into this category. It is a quicker and less-shocking operation than either the Spalding-Richardson composite operation or the vaginal hysterectomy. In many instances, however, it seems desirable to get rid of the corpus uteri for reasons previously mentioned. Then one must choose between the vaginal hysterectomy and the Spalding-Richardson composite operation. Our results have been better with the latter. In our opinion the chief reason for this is that vital structures upon which the support of the vagina chiefly depends, namely, the strong basilar portion of the broad ligaments and the uterosacral ligaments, have been maintained attached to the isthmic portion of the uterus with their blood supply intact (Fig. 64 G).

#### TECHNIC

With the patient in the lithotomy position and after the usual vaginal cleansing, the anterior lip of the cervix is grasped, and the cervix is drawn to the outlet. A mucosa clip grasps the urethral meatus, and slight traction is made on it anteriorly. If the cystocele is large, the mid-line of the anterior vaginal wall is grasped with a succession of mucosa clips from the urethral meatus to the cervix so that the mucosa may be put on a stretch. A transverse incision is made through

the reflexion of the anterior vaginal mucosa onto the cervix about 1 or 2 cm. from the external os. The point of a Mayo scissors is inserted beneath the mucosa in the mid-line, and the anterior vaginal wall is separated from the bladder in the mid-line by alternately opening and closing the scissors. The mucosa clips are removed successively as each is reached. As each segment of 3 or 4 cm. is separated, the vaginal mucosa is cut in the mid-line, ultimately forming the usual inverted T-shaped incision, as in the first step of the cystocele operation. For demonstration of this, the reader is referred to the illustrations of cystocele operation.

Next, the bladder is dissected up from its attachment to the cervix. In order to do this, sharp dissection is first necessary (Fig. 64 A); but after the intimate attachment of the bladder to the cervix has been cut, often the rest of the dissection up to the vesico-uterine fold of peritoneum can be done with blunt dissection by the finger.

The edges of the vaginal flaps that have been grasped with mucosa clips are spread out by assistants, and the pubovesico cervical fascia is dissected from each flap (Fig. 64 B). In the mid-line this fascia is quite thin, but laterally it is usually quite sturdy.

Next, the cervix is amputated. Different technics are permissible for this, but we prefer the technic as described elsewhere in this volume, performing either a high or a low amputation, depending upon the length of the cervix. The posterior lip of the shortened cervix is covered with a flap of mucosa which has been dissected free and then drawn into the canal with a mattress suture as in the Sturmdorf tracheloplasty (Fig. 64 C). The cervical amputation is much less bloody if the cervical branches of the uterine vessels are first ligated bilaterally.

The vesico-uterine pouch of peritoneum is incised as indicated by the dotted line in Figure 64 B, and the fundus is delivered. We have found that the Lahey thyroid clamps used in a hand-over-hand manner are admirably suited for this. If the fundus is so large that it is brought forth with difficulty, a wedge-shaped piece may be excised as in Figure 64 C, or if a myoma is conveniently situated in the anterior wall, a myomectomy may be done.

The uterine end of the round ligament, the

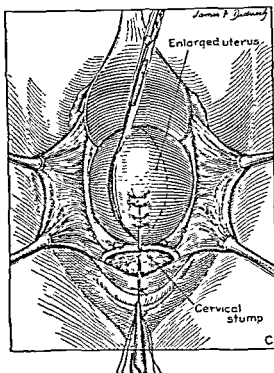
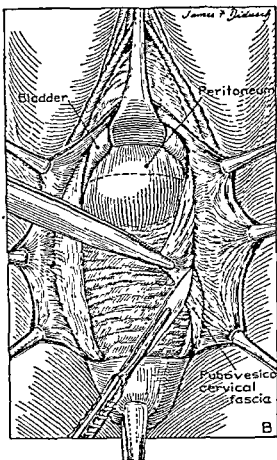
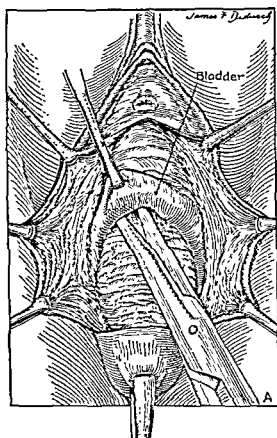


FIG. 64. Spalding-Richardson operation for uterine prolapse. (A) An inverted T-shaped incision has been made, and flaps have been dissected lateralward. The bladder is being dissected free from its attachment to the cervix. (B) The vesicoperitoneal fold of peritoneum has been exposed. The transverse dotted line shows the line of incision. The fascia is being dissected from the flaps of the vaginal mucosa. (C) The fundus is being delivered by traction sutures. Because of its large size in this case, a wedge-shaped piece of myometrium is being excised. The cervix has been amputated.

tube and the ovarian ligament are triply clamped en masse, cut and doubly ligated with No. 1 chromic catgut (Fig. 64 D). This is repeated on the opposite side. A supra-vaginal amputation is done at the desired level. Before making the amputation, the ascending uterine vessels are clamped and ligated below the point of amputation as shown in Figure 64 E. It is well to make this a V-shaped cut, as is done in abdominal



supravaginal hysterectomy, to facilitate closure. Closure of the stump is done with interrupted or figure-of-eight stitches of No. 1 chromic catgut as shown in Figure 64 E. The cut ends of the tubes, the round and the ovarian ligaments are sutured to the stump as indicated in Figure 64 F.

The isthmic portion of the uterus which remains is shown in the diagram in Figure 64 G. It will be noted that it has an ample blood supply. The uterosacral and the portion of the broad ligaments containing the uterine vessels are attached to this remaining segment, and these structures are utilized in building up support for the vagina.

The edge of peritoneum formed by incising the vesico-uterine peritoneal pouch is then sutured to this remaining portion of the uterus (Fig. 64 H). It is well to suture this posterior to the incision line in the uterine musculature so that in case there is any post-operative hemorrhage, the bleeding will be external and not intraperitoneal. Since the description of this operation as given in the first edition of this book and as illustrated in this volume, we have made one alteration

in technic. The lowest portion of the broad ligaments, which are clamped, cut and sutured, as illustrated in our description of the Manchester operation, are brought together

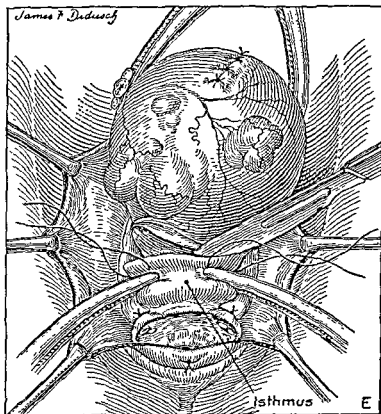
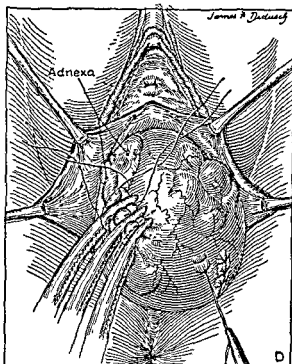


FIG. 64 (Continued). Spalding-Richardson operation for uterine prolapse. (D) The corpus is completely delivered. The round ligament, the tube and the ovarian ligament are clamped en masse, cut as indicated by dotted line and doubly ligated. (E) The corpus is being amputated from the cervix. Uterine vessels are ligated as indicated by sutures.

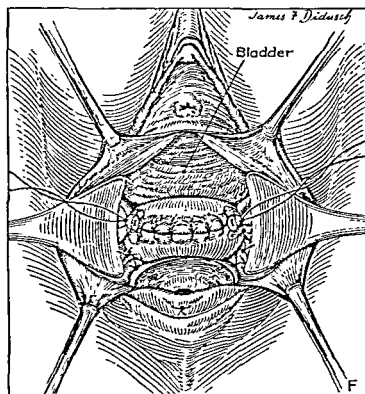
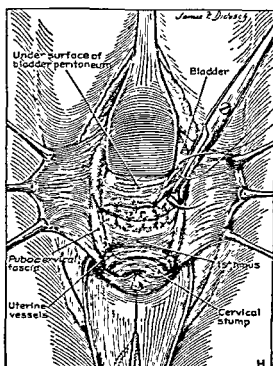
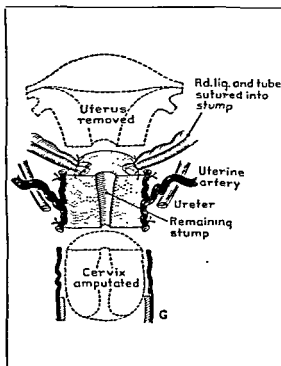


FIG. 64 (Continued). Spalding-Richardson operation for uterine prolapse. (F) The incision in the upper portion of the cervix is closed with interrupted sutures. The tubes, the ovarian ligaments and the round ligaments are sutured to the cervix. (G) Diagram indicating the portion of uterus that remains. Note that the blood supply is intact. (H) The peritoneum is sutured to the isthmus of the uterus posterior to the suture line in the uterus.



and sutured to the anterior surface of the remaining isthmus portion of the uterus, exactly as in performing the Manchester operation. We now regard this step as one of the

most important for it draws the isthmus upward and backward. Thus the advantage of a Manchester operation is attained without the disadvantage of the retained corpus.

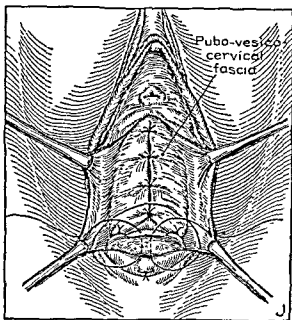
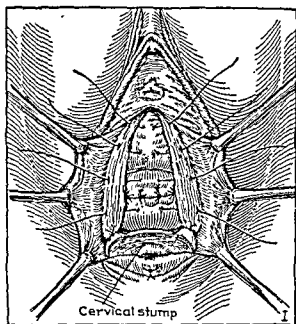
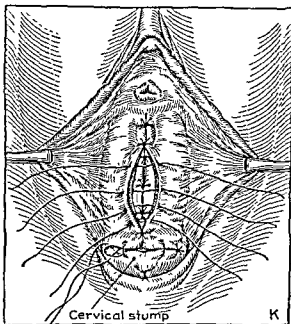


FIG. 64 (Continued). Spalding-Richardson operation for uterine prolapse. (I) Pubovesico-cervical fascia is to be approximated beneath the urethra, the base of the bladder and the cervical stump. (J) Fascia has been completely approximated, and the anterior lip of the shortened cervix is about to be covered with the split flap of vaginal mucosa. (K) Showing final sutures approximating the vaginal mucosa which has been trimmed to appropriate proportions.



The pubovesico cervical fascia is then brought together in the mid-line by interrupted sutures of No. 0 chromic catgut, beginning beneath the urethra, continuing beneath the base of the bladder and finally covering the stump of the uterus (Fig. 64 I, J).

The anterior lip of the shortened cervix is then covered over with vaginal mucosa flaps which have been trimmed down to the proper size for closure (Fig. 64 J). The suturing of the vaginal mucosa laterally over the cervix and of the mid-line incision completes the operation (Fig. 64 K).

The pelvic floor and the rectocele are then repaired as indicated by the degree of relaxation and the size of the rectocele. If an enterocele is present, it likewise is repaired.

#### VAGINAL PLASTIC OPERATIONS COMBINED WITH MODIFIED GILLIAM SUSPENSION OF UTERUS

As previously stated in this chapter, the author does not favor a vaginal plastic operation combined with a round-ligament suspension for uterine prolapse. Only when the desired end cannot be accomplished entirely by the vaginal route do we resort to the combination of operations. In doing this, we realize fully that an operation that hangs up the prolapsed uterus is less satisfactory than those that build up support from below. However,

on occasion one must consider future pregnancies. The vaginal hysterectomy, the transposition operation of Watkins and, to a lesser degree, the Manchester operation are not compatible with future pregnancies. Occasionally, one encounters a young woman with marked descensus of the uterus, vaginal relaxation, rectocele and/or cystocele. If the symptoms of these conditions are not too severe, such a patient should be advised to complete her family and then have the most suitable operation done. Sometimes a pessary can be utilized to advantage for symptomatic relief for a year or two, until after the desired children are born. However, the symptoms of the relaxed condition and prolapse may be so distressing after operation is advisable without long delay. The only procedures possible under such circumstances are a combination of the necessary plastic operation and some type of round-ligament suspension. In doing the vaginal plastic operation in such cases it is possible to plicate the bases of the broad ligaments much as is done in the Manchester operation, omitting the cervical amputation. A modified Gilliam suspension by the round ligaments, close to the uterine cornua, does as well as any type of suspension. Shortening of the uterosacral ligaments also helps to maintain the uterus at the proper level. For the technic of vaginal plastic operations and the Gilliam suspension see the sections devoted to those subjects.

#### VENTRAL FIXATION OF UTERUS OR CERVICAL STUMP FOR PROLAPSE

Ventral fixation of the whole uterus or a part thereof is rarely the proper method of treating uterine descensus. However, in unusual circumstances the procedure may be used to advantage and with good results. In brief, ventral suspension is indicated when prolapse of the uterus occurs in elderly women in whose abdomen there is a lesion which requires laparotomy and upon whom a minimum of surgery for relief of both conditions is indicated. A large ovarian tumor may be responsible for the prolapse by pushing the uterus down in the vagina. Smaller ovarian tumors, although having no etiologic relationship to the prolapsed uterus, require

laparotomy because of the possibility of malignancy. If, on inspection at laparotomy, the ovarian tumor is benign, simple salpingo-oophorectomy may be all that is required for its eradication. Then a quickly performed ventral fixation of the uterus of the elderly woman will often relieve the symptoms of prolapse with a minimum of surgery. When there is marked prolapse and great elongation of the cervix, fixation of the fundus may not elevate the cervix sufficiently to relieve the patient. Amputation of as much of the corpus as necessary may be done, and the rest may be fixed to the abdominal wall. In some instances all of the corpus must be removed and the cervix fixed to get the required elevation.

Occasionally, pelvic adhesions from previous surgery will make the performing of a vaginal hysterectomy, a Spalding-Richardson operation or a transposition operation ill-advised. Through a small suprapubic incision the fundus may be fixed to the abdominal wall.

When indicated, plastic repair of the relaxed outlet, the rectocele and/or the cystocele should be combined with ventral fixation, but if the patient's condition does not permit, the plastic operation may be done at a future time or perhaps not at all.

The technic of ventral fixation of the uterus is described on page 115. The technic of ventral fixation of the cervical stump or vagina in connection with vaginal prolapse is described on pages 159 to 162.

#### THE LE FORT OPERATION

The original Le Fort operation, as described by its author, consisted of a denudation of a long narrow triangle on the posterior wall of the vagina and a similar one on the anterior wall. The bases of these triangles were just below the cervix, and the apices were at the outlet. The closure was brought about by the complete approximation of these denuded areas.

The operation is performed rather frequently in some clinics, but in our opinion it should be done only when there is some good reason why an operation for prolapse which will give a functioning vagina cannot be carried out. Its use is restricted to elderly

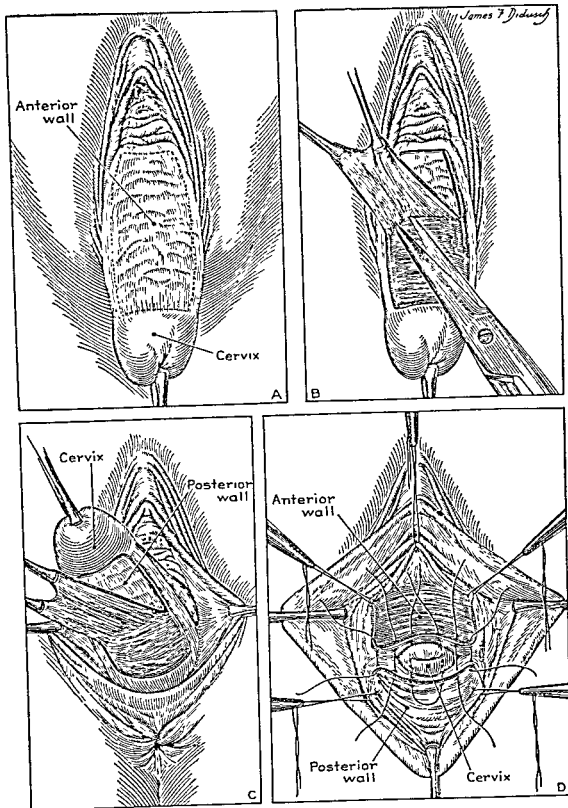


FIG. 65. Le Fort operation for uterine prolapse. (A) Dotted line indicates incision in anterior vaginal wall. (B) Flap outlined is being excised. (C) A similar flap is being excised from posterior vaginal wall. (D) The vaginal mucosal edge is being approximated beneath the cervix.

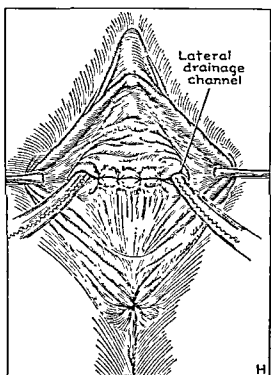
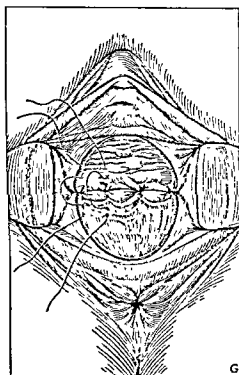
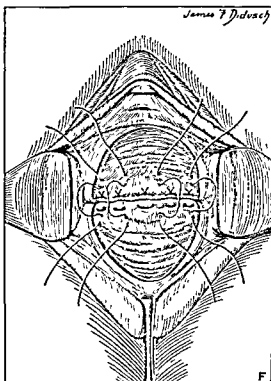
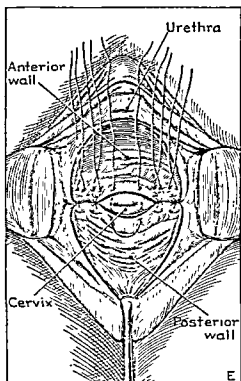


FIG. 65 (Continued). Le Fort operation for uterine prolapse. (E, F, G) The denuded areas on the anterior and the posterior walls are approximated by several layers of interrupted sutures of No. 0 chromic catgut. (H) Finally, the mucosal edges are closed. Note the tunnels left on either side, demonstrated by Kelly clamps.

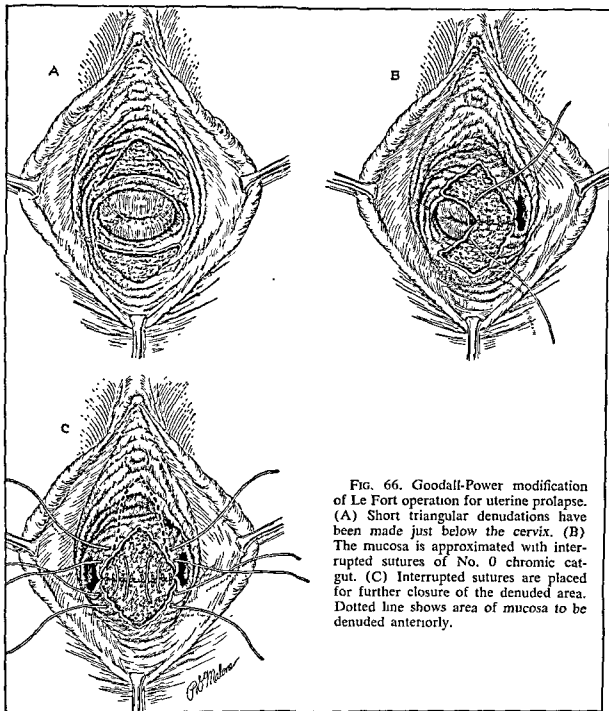


FIG. 66. Goodall-Power modification of Le Fort operation for uterine prolapse. (A) Short triangular denudations have been made just below the cervix. (B) The mucosa is approximated with interrupted sutures of No. 0 chromic catgut. (C) Interrupted sutures are placed for further closure of the denuded area. Dotted line shows area of mucosa to be denuded anteriorly.

widows or to women who, with their husbands, have no further interest in marital relations. We are inclined to regard it as an admission on the part of the surgeon that he is unable to cure the prolapse by some procedure which would leave a functioning vagina; yet there are rare cases in which it is very useful. Its virtue lies in the fact that it is perhaps the least shocking of any of the procedures used for the cure of prolapse, and

that it can be done safely, under local anesthesia if necessary, in elderly women who might otherwise be condemned to a pessary. Regardless of the age of the patient, the closure of the vagina should never be done without a complete understanding on part of the patient as to the termination of her sex life. A disadvantage to the typical Le Fort operation lies in the fact that occasionally partial urinary incontinence results, due to the pull

of the posterior vaginal wall on the anterior wall that is intimately attached to the urethra and the trigone. This disadvantage can be avoided by closing only the upper portion of the vagina, stopping short of the area which underlies the vesical trigone and the urethra. In fact, in recent years we have practically abandoned the typical operation in favor of closing only the upper two thirds of the vagina. If there is a urethrocele, an oval area of mucosa is denuded beneath the urethra and closed longitudinally. Then the levators are approximated very tightly, leaving only enough opening for urination.

#### TECHNIC

With the patient in the lithotomy position, the cervix is drawn outward as far as possible. In the cases in which the Le Fort operation is done, this more or less completely everts the vagina.

The area to be denuded anteriorly is marked out with the scalpel as indicated by the dotted line in Figure 65 A. Sufficient mucosa should be left laterally to form a canal for drainage of cervical secretions. The area to be denuded extends to within 2 cm. of the tip of the cervix and to within 2 cm. of the urethral meatus.

The mucosa is denuded from the anterior vaginal wall by a combination of sharp and blunt dissection (Fig. 65 B).

An area of mucosa of equal size and shape is denuded from the posterior vaginal wall (Fig. 65 C).

The mucosal edges are approximated transversely below the cervix with interrupted sutures of No. 0 chromic catgut (Fig. 65 D).

Beginning at the top, the denuded areas are approximated with as many rows as necessary of interrupted sutures of No. 0 chromic catgut (Fig. 65 E, F, G).

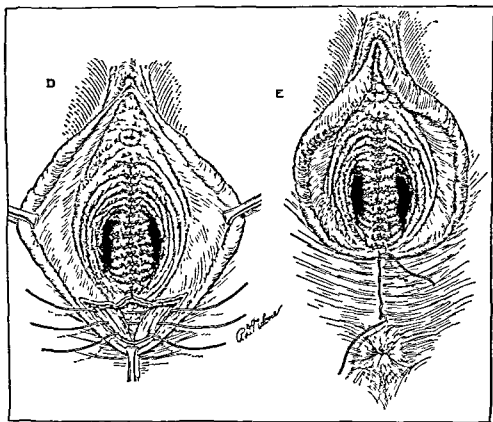


FIG. 66 (Continued). Goodall-Power modification of Le Fort operation for uterine prolapse. (D) The upper vagina has been closed by approximating denuded triangular areas. A cystocele has also been repaired. The perineum is being repaired. (E) Completed operation.



Finally, the mucosal edges are approximated with interrupted sutures of No. 0 chromic catgut (Fig. 65 H). Mucosa-lined tunnels left on both sides are demonstrated by the Kelly clamps in Figure 65 H.

#### GOODALL-POWER MODIFICATION OF LE FORT OPERATION

Goodall and Power have modified the Le Fort operation to permit fairly satisfactory coitus and thus increase the scope of the operation. It is our opinion that there exist few indications for this modification. In almost all cases of prolapse in younger women, where coitus is of considerable importance, some other type of operation can be done that results in a better vagina. However, in rare conditions when there have been previous unsuccessful attempts at cure and the structures appear to be so poor that cure with a normal vagina seems to be hopeless, this operation may be desirable. It consists essentially of closure of the upper portion of the vagina by approximating triangular denuded areas. If the anterior wall below the level of vaginal closure is redundant, the mucosa may be excised as shown in Figure 66. Then an appropriate posterior perineal repair is done.

#### TECHNIC

With the patient in the lithotomy position, traction is made on the cervix which, in the type of case in which this operation is done, practically everts the vagina. A triangular area of the vagina is denuded of mucosa with the base of the triangle about a centimeter from the cervix. If the vagina is short, this

triangular area should not be over one third the length of the vagina. If the vagina is long, it may be one half the length of the vagina (Fig. 66 A).

Mucosal edges of triangle bases are approximated with interrupted sutures of No. 0 chromic catgut (Fig. 66 B).

Interrupted sutures of No. 0 chromic catgut are placed laterally, as indicated in Figure 66 C. These sutures pick up the mucosa and also some of the adjacent raw surface so that when they are tied there will be no dead space. Before these sutures are tied, the anterior vaginal wall is opened up for repair of the cystourethrocele. An area of mucosa is removed as indicated in Figure 66 C. The pubocervical fascia is dissected free from the mucosa and brought together in the mid-line as in the usual cystocele operation. The lateral sutures are tied at this stage, and the anterior mucosal wound is closed with interrupted sutures of No. 0 chromic catgut.

An area of mucosa is denuded posteriorly, as indicated in Figure 66 D. The levator muscles are approximated with interrupted sutures of No. 0 chromic catgut.

Finally, the perineal wound is approximated with a continuous subcuticular suture of No. 0 chromic catgut (Fig. 66 E).

The vagina which results is single in the lower portion and double in the upper part. The obliterated upper vagina gives the patient a fixation point upon which the cervix rests. In the lower portion of the vagina, the anterior and the posterior walls have been restored, and the resulting vagina, although it has been shortened, is fairly satisfactory as to function.

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# Prolapse of the Vagina, With or Without Cervix, Following Hysterectomy

## GENERAL CONSIDERATIONS

Slight vaginal prolapse, too slight to make the patient conscious of it, not infrequently occurs following hysterectomy. More or less complete vaginal prolapse rarely occurs following abdominal or vaginal panhysterectomy, and more rarely still following subtotal removal of the uterus. Today, when subtotal hysterectomy is becoming less frequent, prolapse of the cervical stump is indeed a rarity. The reason for the occurrence of prolapse more frequently after total hysterectomy is probably the fact that when any type of total extirpation of the uterus is done, there must be some crushing of the cardinal and the uterosacral ligaments, whereas when subtotal removal is performed the amputation usually is done above the level of these ligaments. Failure to utilize properly the ligamentous supports in rebuilding the upper pelvic floor is a major factor in the occurrence of prolapse of both the cervix and the vagina after hysterectomy. The occurrence of this condition following removal of the uterus may also be due to failure to recognize and deal with some degree of descensus, relaxed outlet, rectocele, cystocele or enterocele at the time of the hysterectomy. These conditions, which represent a failure of the under-supports of the uterus, may be symptomless at the time of hysterectomy and later give rise to symptoms. This is not to say that all symptomless vaginal relaxations should be repaired when hysterectomy is done. Many of the relaxations of both the anterior and the posterior walls never will require correction, but their presence should be noted, and when it is felt that more support to the cervix or the vagina is necessary than can be given

by the intra-abdominal suspension, the support should be augmented by the indicated vaginal plastic operation.

Senile changes in the tissues of the vagina and the ligamentous supports undoubtedly are factors in some cases of vaginal prolapse. Hence, no matter how meticulous a job is done for vaginal support at the time of the primary operation probably there will always be a very small irreducible number of women who develop vaginal prolapse.

Even today a few cases of vaginal prolapse are encountered following abdominal hysterectomy for uterine prolapse. This procedure alone has no place in the treatment of genital prolapse, and properly trained surgeons recognize this.

Protrusion of a mass from the vaginal outlet is the symptom that usually brings these women with prolapse of the vagina or the cervix to seek relief. Walking and sitting may become difficult for them. Cystocele, rectocele and/or enterocele associated with the vaginal or cervical prolapse may produce the usual symptoms due to these herniations.

## TREATMENT

The treatment of vaginal prolapse depends first of all upon an evaluation of the anatomic condition. Then one must consider the age and the general physical condition of the patient and her views on further sexual activity. In the woman who is a very poor operative risk, a pessary is occasionally satisfactory, but sometimes marked vaginal relaxation associated with complete inversion of the vagina prevents the use of a pessary. Often this condition occurs in elderly women who have no interest in further sexual life.

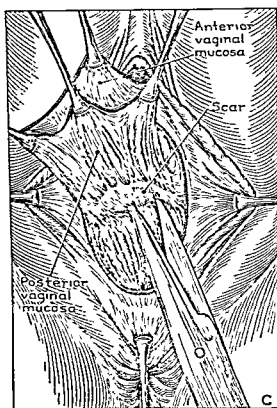
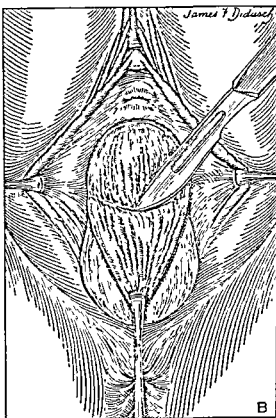
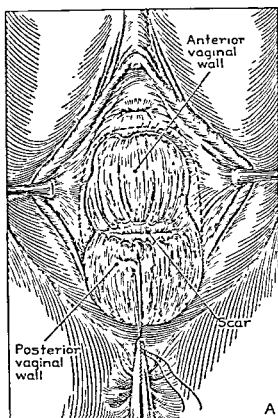


FIG. 67. Colpocleisis for vaginal prolapse following total hysterectomy. (A) Dotted line indicates incision, encircling vaginal vestibule. (B) The anterior vaginal wall is dissected free. (C) The posterior vaginal wall is dissected free.

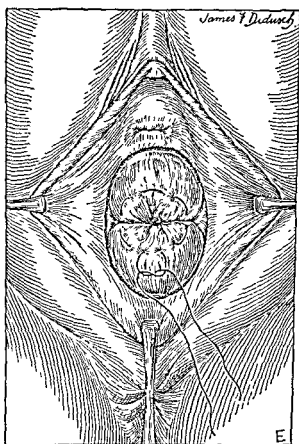
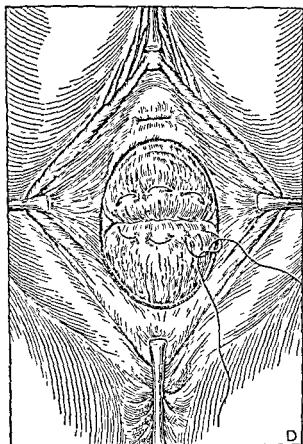
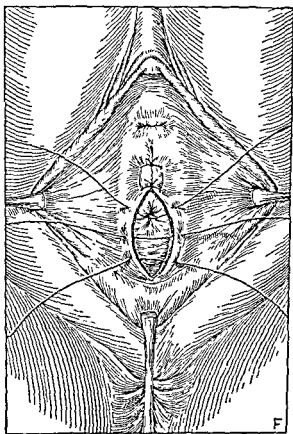


FIG. 67 (Continued). Colpocleisis for vaginal prolapse following total hysterectomy. (D) The vagina is closed with successive purse-string sutures, placed from above, downward. (E) The second purse-string suture is placed. (F) The last purse string has been tied, and the mucosa is approximated with interrupted sutures.



In those women, complete or partial colpocleisis can be done with a minimum of operative shock and quite a satisfactory result to the patient. When the cervix is still present a typical Le Fort operation or a modification of it, such as that described by Goodall and Power, may be done. When the cervix has been removed a complete colpocleisis is quite satisfactory in this group of elderly women (Fig. 67).

Occasionally, a case of prolapse is encountered in which a long cervical stump, due to high amputation, is present. If the prolapse is not complete, and if there is a desire to save a functioning vagina, a modified advancement operation for cystocele may be done with plication of the bases of the broad ligaments anterior to the cervix as in the Manchester operation. If the vaginal portion of the cervix is elongated, it should be amputated. When these conditions exist, sometimes the long cervical stump may be interposed as in the Watkins operation.

When because of her youth and desire to preserve the function of the vagina, preservation of a vagina of normal depth and caliber is necessary, surgical ingenuity may be put to a severe test. There is no single operation that will be adequate in all cases. Careful preoperative planning to suit the individual case is desirable, but, in spite of the most meticulous preoperative plans, improvising at the operating table is often necessary. One can only use the supporting structures at hand, and their quality is often not apparent until they are inspected at operation. In some instances the supports of the vagina can be so utilized that the entire surgical job can be done from below. However, in many instances a combination of vaginal plastic procedures and some kind of abdominal suspension are necessary for a satisfactory result. Usually, when vaginal prolapse occurs after either total or subtotal operation, a cystocele, a rectocele and/or an enterocele will be found to be present. These conditions occur in various combinations. We have seen well-preserved anterior and posterior vaginal walls with a hernia defect at the vaginal vault through which an enterocele sac protrudes. We have also seen only a cystocele present with an intact posterior wall. Likewise, a rectocele may be present

with a well-supported bladder. In any case, one can be certain that the restoration of the vagina to a semirigid tube greatly increases the chances of a lasting cure.

Pratt and Symmonds have divided their cases into 3 groups. Such a division is very useful when planning the surgical attack.

The first type consists of a relatively pure enterocele, with or without rectocele, that develops behind a well-supported anterior vaginal wall. This type usually occurs after a vaginal hysterectomy and probably represents a neglected enterocele or potential enterocele. Such cases can usually be cured by dissecting out the enterocele sac, obliteration of the cul-de-sac and proper repair of the rectocele.

The second type includes a moderate prolapse of the vaginal vault combined with enterocele, cystocele and rectocele. In these cases there is a general laxity of the urogenital support, and usually they can be cured by a vaginal approach. This consists of dissection of the enterocele with high ligation of the sac, approximation of the uterosacral ligaments and fixation of the uterosacral and the cardinal ligaments to the vaginal vaults as should be done in vaginal hysterectomy. Then appropriate anterior and posterior colporrhaphy should be done. If on completion of these procedures the operator is not satisfied with the vaginal support, some type of abdominal fascia support can be added. These vaginal procedures often result in some shortening of the vagina.

The third and most difficult type to repair is complete vaginal inversion. Perhaps eversion would be a better descriptive term for the entire vagina is everted from the introitus. Many of the women with this condition are in the age group when a functioning vagina is of little importance. Colpocleisis can be done and in our hands has given very satisfactory results. However, when a functioning vagina is desired, cases often require a dissection and an obliteration of the enterocele, a rebuilding of the anterior and the posterior vaginal walls and perineorrhaphy, combined with some type of abdominal suspension. Abdominal suspension alone in these cases is usually quite unsatisfactory. Also, the tissues which one has to work with below are usually inadequate. Hence, the combined

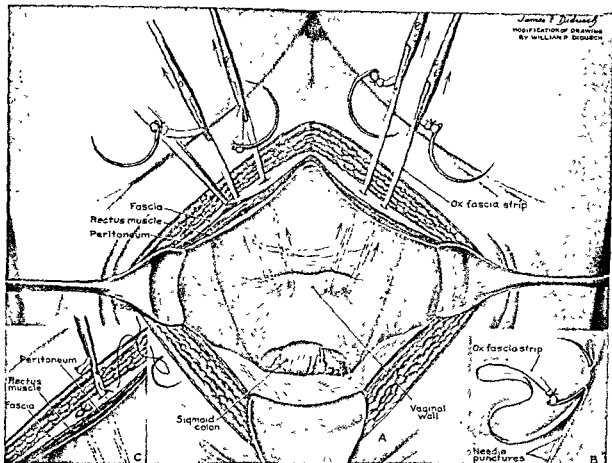


FIG. 68. Grant Ward operation for suspension of prolapsed vagina with preserved fascia strips. (A) Position of fascial strips beneath peritoneum and through abdominal wall structures. (B) Method of placing fascia beneath peritoneum. (C) Method of suturing fascial strips to outer surface of rectus sheaths.

procedures usually offer the best chance of success.

We are presenting herewith some operations which we have found useful, but the operator must select the proper procedures and suit them to the individual case. Often he must improvise and approach the operation with an open mind, being willing to change his planned approach as the operation proceeds.

Williams and Richardson described a similar operation, using bilateral strips of fascia from the aponeurosis of the external obliques.

Several of these operative procedures will be described and portrayed in detail, since it is the opinion of the author that no single operation fits all cases of vaginal prolapse. Therefore, it is essential that the surgeon be familiar with several technics in order to

choose wisely the best procedure for the individual case.

The operator should be warned not to become too enthusiastic about his result until a few years have elapsed. The immediate result appears good in almost all cases, but a few years of wear and tear are required before the ultimate result can be evaluated.

#### TECHNIC: COMPLETE COLPOCLEISIS FOR PROLAPSE OF VAGINA FOLLOWING TOTAL HYSTERECTOMY

An incision is made about the circumference of the vaginal outlet in the region of the carunculae myrtiliformes as indicated in Figure 67 A. The mucosa of the anterior vaginal wall is dissected free up to the top of the vagina (Fig. 67 B). The posterior vaginal mucosa is then dissected free, and

thus all of the vaginal mucosa is removed (Fig. 67 C).

The method of closure of the vagina depends on its caliber. If the vagina is small, it is closed with a succession of purse-string sutures of No. 0 chromic catgut as indicated in Figure 67 D, E. If the caliber of the vagina is too large to be closed conveniently with purse strings, it is closed with a series of continuous sutures placed transversely. The vaginal mucosa is closed vertically with interrupted sutures of No. 0 chromic catgut (Fig. 67 F).

**TECHNIC: OPERATION FOR PROLAPSE OF VAGINA FOLLOWING TOTAL HYSTERECTOMY, USING PRESERVED FASCIA LATA OF OX (GRANT WARD)**

An incision is made from umbilicus to symphysis, and the peritoneal cavity is entered. The intestines are packed back, if necessary, and the pelvic region is exposed.

One strong suture of preserved ox fascia lata in a Koontz fascia needle is placed through the vaginal vault on the right side as illustrated in Figure 68 A. The fascia is then worked beneath the peritoneum laterally and anteriorly to the region of the internal abdominal ring. It is made to pierce the rectus muscle and the sheath which is exposed by dissecting the fat from it laterally from the mid-line incision.

The fascia is carried under the peritoneum by running the large needle under the peritoneum for its full length, then bringing it out and reinserting it in the large needle hole, continuing subperitoneally. This is carried out step by step until the fascial strip has been brought to the desired point. The small openings in the peritoneum made by the needle leave practically no raw surface. They can be seen in Figure 68 B.

The other end of the first suture, attached to the vaginal vault, is then threaded onto a Koontz fascia needle, and in a similar subperitoneal manner it is carried anteriorly under the peritoneum of the bladder to the symphysis region. It is made to pierce the rectus muscle and its sheath and is then anchored to the anterior surface of the fascia. The ends of the fascia strips are sutured to the fascia with fine black-silk sutures.

This procedure is repeated on the oppo-

site side, so that finally the vagina is supported by 4 fascial strips.

In using Koontz preserved fascia lata of the ox, it must be remembered that this preserved tissue does not become an integral part of the host, unless it is embedded in a vascular area to permit its organization by fibroblasts growing from the adjacent tissue. The preserved fascia acts as a scaffolding on which this tissue grows.

The burying of the fascial strips beneath the peritoneum also prevents them from extending like guy ropes across the peritoneal cavity to entrap a loop of bowel.

**TECHNIC: WILLIAMS AND RICHARDSON METHOD FOR SUSPENSION OF PROLAPSED VAGINA WITH OR WITHOUT CERVICAL STUMP**

The vaginal vault is elevated by packing the vagina tightly with gauze, leaving the end long so that it can be removed during operation without disturbing the drapes. A Pfannenstiel incision is made through the skin and subcutaneous tissues from a point about 3 cm. medial to the anterior superior iliac spine to a similar point on the opposite side. The external oblique aponeurosis is cleaned carefully for a space at least 3 cm. wide throughout the length of the incision. A strip of the external oblique aponeurosis 1.5 cm. wide is dissected free, the inferior margin of which must be carefully determined so that it splits the fibers of the aponeurosis about 1 cm. above the border of the external inguinal ring. The strips are then detached from the linea alba and laid aside, leaving them attached to the muscle belly laterally (Fig. 69). The medial portions of the strips will, of course, contain re-enforcing fiber from the internal oblique. The Pfannenstiel incision is next completed, and the rectus muscles are retracted laterally. The apex of the previously packed vagina is identified and pulled up with a figure-of-eight traction suture, after which the vaginal pack is removed. Using a large Kelly clamp, the internal oblique and transversus abdominis muscles are perforated at the attached ends of the fascial strips which should be slightly above the abdominal inguinal ring. The tip of the clamp is insinuated between the leaves of the broad ligament along the course of the round ligament. The peritoneum is perforated at the lateral fornix of the vagina, and the tip of another Kelly clamp is grasped and drawn back through the tunneled path to the perforation in the rectus muscle.



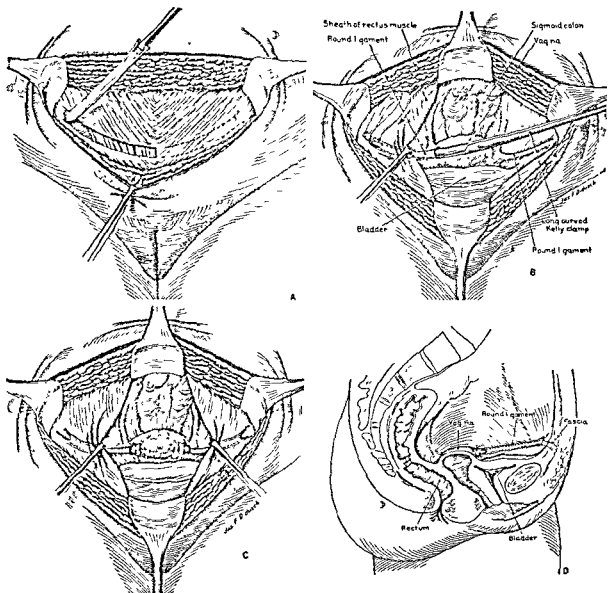


FIG. 69. (A) A transverse incision has been made through the fat, and a suitable area of fascia has been cleaned of fat. One fascial strap has been dissected free. (B) A tunnel is made through the leaves of the broad ligament beneath the round ligament. The muscles are perforated with the tip of the clamp, and the end of the strap is grasped. (C) The fascial straps have been drawn between the leaves of the broad ligaments and sutured to the corners of the vagina. (D) Sagittal view, showing mechanism by which vagina is held in place.

With this second clamp the free end of the fascial strip is grasped and drawn extraperitoneally to the lateral fornix of the vagina and attached thereto with interrupted sutures of medium fine silk. When repeated on the opposite side, a musculofascial sling is formed which pulls the fornices of the vagina upward and laterally. Enterocoele of any degree should receive adequate attention at this time. Closure of the abdominal wound completes the operation. No difficulty has been encountered in

closing the defect left by the excised strip of fascia.

#### TECHNIC: FIXATION OF VAGINAL VAULT TO ANTERIOR ABDOMINAL WALL

After doing whatever repair work is found necessary per vaginum the operator may be dissatisfied with the suspension of the vagina. Fixation of the vaginal vault by the following technic may be of value. The vagina must be

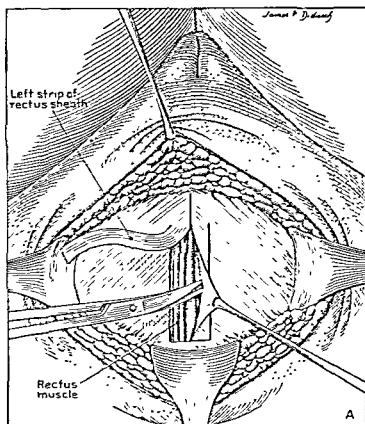
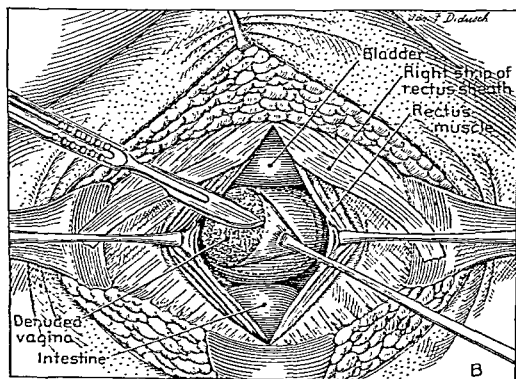


FIG. 70. (A) Two narrow strips of fascia are cut from either side of the mid-line incision. (B) The top of the vagina is denuded of serosa.



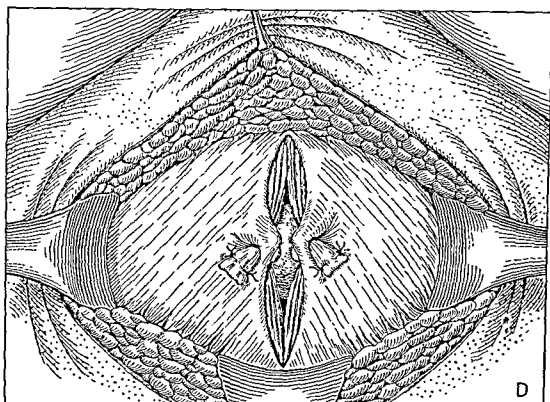
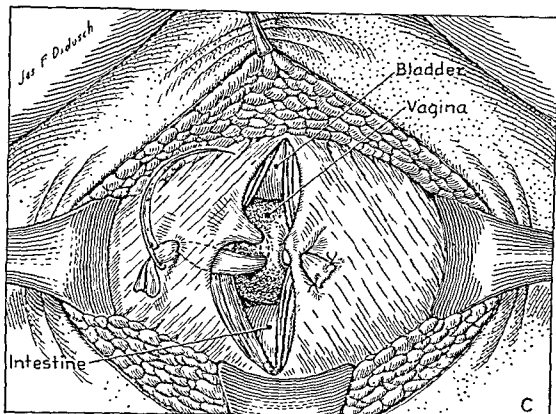


FIG. 70 (Continued). (C) Using a large fascia needle, the denuded top of the vagina is sutured to the undersurface of the rectus sheath. (D) Fascia strips are sutured to the outer surface of the rectus sheath with silk sutures.

long enough and mobile enough to reach the abdominal wall; if not, the Grant Ward or Williams Richardson technic would be preferable.

A low mid-line incision is made, and 2 strips of fascia about 1 cm. in width are cut from the rectus sheath as shown in Figure 70 A.

After entering the peritoneal cavity the vagina which has been packed with gauze is identified. The vault is denuded of peritoneum as shown in Figure 70 B. If the

bladder is adherent over the vault, it is dissected free and pushed anteriorly.

Large cutting fascia needles which have been threaded with the fascial strips are then used to suture the dome of the vagina to the undersurface of the rectus sheath (Fig. 70 C). The ends of the fascial strips are tied down to the anterior rectus sheath with non-absorbable sutures such as silk or mersilene (Fig. 70 D). The fascial incision is then closed with figure-of-eight sutures of No. 1 chromic catgut.

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# The Use of Pessaries

One of the oldest appliances used in medicine is the vaginal pessary. With the advent of modern surgery the use of pessaries became less prevalent and less important; yet today the proper use of pessaries in selected gynecologic cases is an accomplishment that every gynecologist should master.

Only 3 types of pessaries remain in general use today of the great assortment that was manufactured in the past. These are the Smith-Hodge, the ring and the Menge types.

## THE SMITH-HODGE PESSARY

The Smith-Hodge pessary is used to hold the retroposed uterus in ante-position. It should be remembered that this pessary does not bring the retrodisplaced uterus forward. It simply holds it in position after it has been brought forward manually.

**Indications.** It has been stressed in the chapter on retrodisplacement of the uterus that most uteri in retroposition are asymptomatic and require no treatment. This is

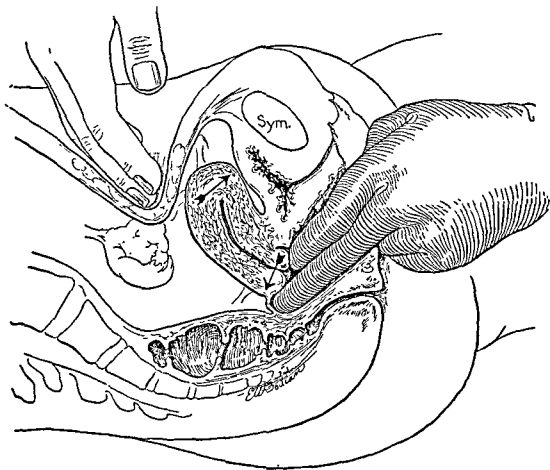


FIG. 71. Showing method of replacing uterus into ante-position. The vaginal fingers push the cervix postero-inferiorly. Pressure is exerted on the posterior surface of the fundus with the abdominal hand.

equally true whether one is considering surgery or the use of pessaries. The use of the pessary to hold the uterus forward is indicated under the following conditions:

1. *As a therapeutic test* when there is doubt as to whether the position of the uterus is responsible for the symptoms of which the patient complains. After holding the uterus in good position for a few months the patient should be relieved of her symptoms, if they are dependent upon the retrodisplacement. If the response to this treatment is equivocal, the pessary may be removed and left out for a time to see whether or not the symptoms

become aggravated. By observation on the part of the patient and the physician the possibility of relief by suspension usually can be ascertained in this way.

2. *To hold the uterus in anteversion during early pregnancy.* When during early pregnancy the uterus is in deep retroversion, and particularly when there is a high degree of retroflexion, the inability of the fundus to rise above the sacral promontory can be responsible for abortion, usually between the 3rd and the 4th months. The holding of such a pregnant uterus in anteversion to the end of the 4th month by means of a Smith-Hodge

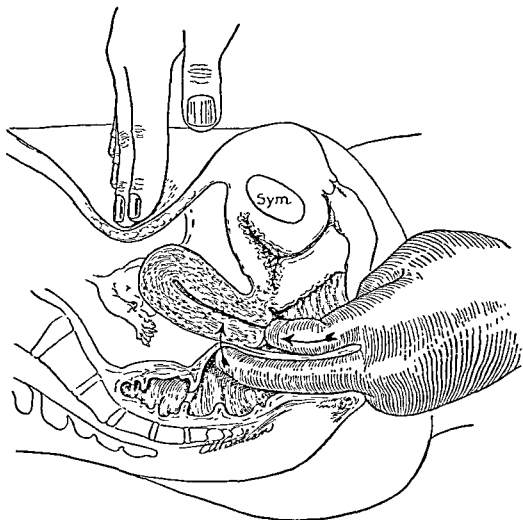


FIG. 72. Showing method of replacing uterus anteriorly. With the index finger in the vagina the cervix is pushed posteriorly. With the rectal finger the uterus is boosted anteriorly.

pessary is particularly indicated when there is a history of repeated abortions.

3. *To give temporary relief from symptoms of retrodisplacement when surgical correction is to be deferred.* A common reason for deferring surgical treatment may be the desire for more children before a corrective operative procedure is done, which may be performed more advantageously after completion of the family when a vaginal hysterectomy may often be combined with vaginal plastic operation. Suspension operations may also be deferred for economic reasons or because of compelling duties.

4. *Occasionally because of sterility.* If after thorough investigation of the infertile

couple all is found in order except a marked retrodisplacement, suspension of the uterus on the rather remote chance that it will relieve the sterility scarcely seems to be justified. The doubtful benefit of maintaining the uterus in good position may be attained by the use of the Smith-Hodge pessary.

5. *During the puerperium or after abortion.* Shortly after delivery or abortion, the retrodisplaced uterus may give rise to rather severe low backache and bearing-down pelvic discomfort. Often this can be relieved by holding the uterus forward with a pessary. The improvement in the circulation of the uterus in good position for several weeks may remain after removal of the pessary.

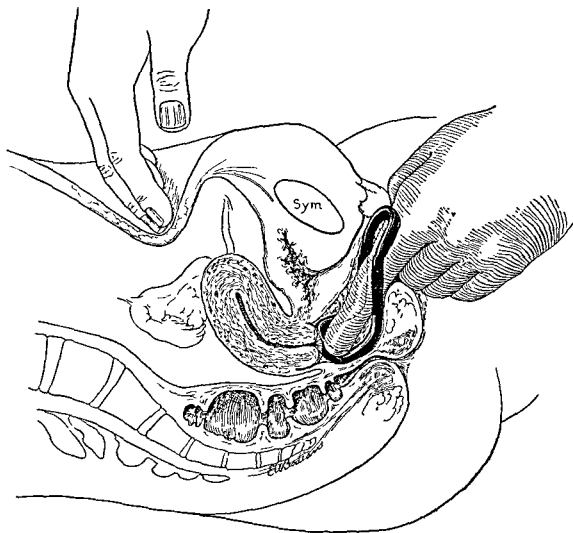


FIG. 73. The Smith-Hodge pessary has been introduced into vagina. The cross bar is being depressed to place it behind the cervix.

Even if the uterus does become retrodisplaced after removal of the pessary, the smaller organ in the cul-de-sac often gives rise to no symptoms.

**Contraindications.** Using the Smith-Hodge pessary is contraindicated in the presence of vaginitis. This contraindication applies equally to other types of pessaries, for the presence of a foreign object within the vagina prevents the healing of the inflammatory process. Also, the pessary should be excluded when acute cervicitis is present, but there is no contraindication with the usual case of chronic cervicitis. Acute salpingitis also obviously contraindicates the pessary. When chronic salpingitis or endometriosis is present and the uterus is bound in the cul-de-sac, it is quite useless to attempt to hold it forward by means of a pessary.

**Replacing the Retrodisplaced Uterus.** The first essential step before inserting the pes-

sary is the replacement of the uterus into normal ante-position. This may be attained with the greatest of ease, but on occasion it may be extremely difficult. Simply pushing the cervix posteriorly with one or two fingers in the vagina may cause the fundus to come forward. This maneuver may be augmented by pressure on the abdomen in an attempt to work the abdominal hand into the pelvis behind the uterus. The fundus is pushed forward at the same time that the cervix is pushed posteriorly (Fig. 71). When the cervix is short it may be difficult to sustain pressure against the anterior lip. In such cases pressure on the posterior fornix may draw the cervix back. Another maneuver which is useful when the finger slips off the cervix is to grasp the anterior lip with a tenaculum and exert pressure posteriorly by this means.

One of the most useful procedures is to insert the index finger into the vagina and

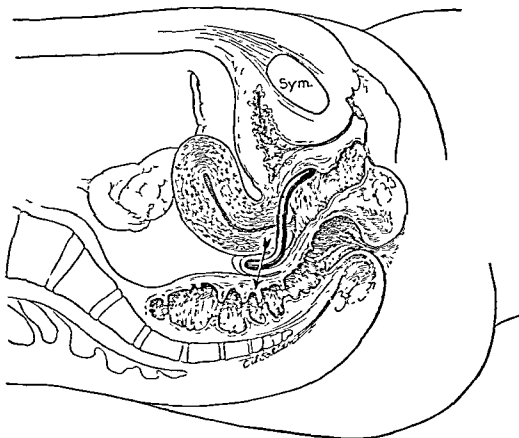


FIG. 74. Showing mechanism of holding uterus in ante-position by Smith-Hodge pessary.



the middle finger in the rectum. While the index finger presses the cervix back, the middle finger is made to boost the fundus forward. Pressure is made with the abdominal hand in an attempt to bring the fundus forward (Fig. 72).

**Insertion of the Pessary.** After replacement of the uterus into its correct position it is often well to have an assistant maintain gentle pressure on the anterior abdominal wall to prevent its slipping back. With the operator's left hand the labia are spread and the broad end of the lubricated pessary is brought in apposition with the outlet. The pessary should be pressed into the vagina obliquely as this represents the greatest diameter of the vaginal outlet. As soon as the broad end of the pessary passes the levator muscles it is rotated so that it lies transversely, and the cross bar is pushed behind

the cervix (Fig. 73). The pessary thus makes pressure on the posterior vaginal fornix which in turn holds the cervix back (Fig. 74). If the cervix is held posteriorly, the uterus, being a semirigid structure, remains in anteposition by virtue of the intra-abdominal pressure on the posterior surface.

The pessary should be large enough to remain in place without dropping from the introitus and without shifting within the vagina. It should be large enough to press gently against the suburethral vaginal mucosa and thus have a point of counterpressure in order to exert moderate pressure on the posterior fornix. On the other hand, if it presses too tightly against the urethra the patient may be unable to void. It should not be so tight as to be uncomfortable or produce pressure necrosis and ulceration of the mucosa.

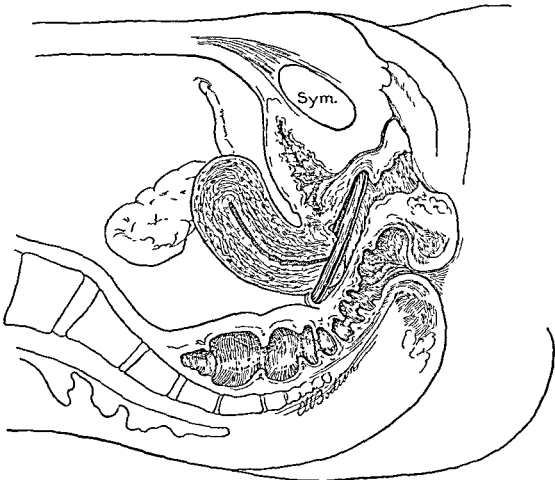


FIG. 75. Ring pessary is in place, keeping the redundant anterior vaginal wall from prolapsing.

Often the pessary can be shaped to fit the vagina of a particular individual by modifying its shape after dropping it momentarily into boiling water. By this method it may be narrowed, lengthened, widened, shortened or its curves modified so as to be moulded more nearly to the shape of the vaginal cavity.

After the pessary has been fitted the patient is asked to walk about the examining room for a few minutes to determine whether or not she is comfortable. Then she is asked to get on the table again, and the position of the pessary and the uterus is checked. It is our custom to have the patient return in a week to determine if she is comfortable. The position of the pessary and the uterus is checked again, with the patient on the examining table. If all is well, the woman is asked to return every four months in order that the vaginal mucosa may be inspected and the position of the uterus checked. Re-

moval of the pessary may not be necessary if all is well. While wearing the pessary the patient is asked to take a daily cleansing douche.

### THE RING AND THE MENGE PESSARIES

Admittedly, the best cure for prolapse and cystocele is surgery. However, palliation is indicated not infrequently. In young women who desire more children it is desirable to relieve symptoms temporarily by means of the pessary until another pregnancy is completed; then radical and often sterilizing surgery may be done with satisfactory results. There is also a rather large group of elderly women who are very poor surgical risks, due to cardiac and/or renal disease, diabetes, etc., who suffer from prolapse and cystocele of varying degree.

The ring pessary may be used quite satis-

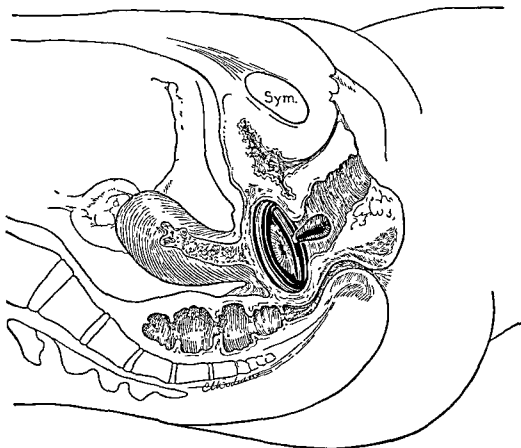


FIG. 76. Menge pessary is in place, preventing the cervix from descending.

factorily for cystocele and slight descensus. It is inserted obliquely into the vagina and twisted as soon as it passes the levators so that it lies obliquely as shown in Figure 75. If the outlet is sufficiently narrow to permit the pessary to remain in place, the cervix is supported, and the anterior vaginal wall is placed on stretch sufficiently to prevent the cystocele from protruding.

When there is a marked prolapse the ring pessary seldom supports the uterus sufficiently to take care of the condition. Then a pessary of the Menge type is the one of choice. The knob which fits into the cross

bar is detachable, and the ring is inserted without it. After the ring is adjusted transversely in the vagina the knob is inserted and turned to lock into position. The cervix thus rests in the ring, and the knob maintains the ring in a transverse position (Fig. 76). The knob is held in its downward position by the levators, the urethra and the rectum, which structures prevent it from being deflected laterally, anteriorly or posteriorly.

As with other types of pessaries, daily douches and return visits to the gynecologist's office at three-month intervals are required.

## Urethrocele, Cystocele and Stress Incontinence of Urine

Urethrocele and cystocele should be discussed together, for although either may occur independently, some degree of one is usually present with the other. Also, some descent of the uterus is often associated with these two conditions, but not invariably so. Particularly, urethrocele may be present when the uterus is in excellent position.

### URETHROCELE AND CYSTOCELE

Urethrocele is a protrusion downward of the urethra from its attachment just beneath the symphysis pubis. It results from inability of the musculo-fibrous tissue to give it normal support. Childbirth injuries to the urogenital trigone and the pubovesicocervical fascia are chiefly responsible for the condition, although it is seen occasionally in a nulliparous woman. Injury to the above structures may be so great as to result in the formation of a urethrocele immediately after childbirth, but in many instances the supporting structures are left in sufficiently good condition to support the urethra for a time. Years later, with the natural loss of tone of supporting tissue and the stress and strain of work, the urethra may prolapse and the symptoms of urethrocele develop.

Sometimes a urethrocele alone may cause such bulging that the patient will consult the doctor relative to this protrusion. Aside from the bulging there may be no inconvenience, but the most uniform symptom of urethrocele is stress incontinence of urine. In the lesser degree of this, the patient spurts a few drops of urine on coughing, sneezing or straining. There is usually a tendency for this slight degree of incontinence to become aggravated with the passage of time, and occasionally

there results a complete incontinence when the patient is standing. Usually, even in these extreme cases, there is little or no difficulty when the patient is lying down. The defect in the mechanism causing this type of incontinence is due to the inability of the circular, constricting urethral muscle fibers to contract normally when the urethra is pulled downward with the prolapse vaginal wall (Fig. 77). If one observes the closing of the normal urethra through a Kelly cystoscope, the circular, camera-shutterlike action of the normal sphincter is obvious. When the vaginal mucosa bulges downward on straining, it pulls with it the undersurface of the urethra and the internal sphincter. Thus the normally round urethral lumen is converted into an oval, and the circular muscles cannot function effectively. Usually, one can prevent the spurt of urine by simply supporting the vaginal mucosa very lightly beneath the urethra with the index finger as the patient coughs. This gives one a clue as to the surgical cure, for by simply supporting the prolapsed urethra by bringing together the injured subjacent fascia the patient usually is cured of the incontinence. For further consideration of stress incontinence of urine, see discussion on the subject later in this chapter.

Cystocele is a herniation of the bladder, causing the anterior vaginal wall to bulge downward. Like urethrocele, it is usually the result of childbirth injury. The child's head may stretch and separate the pubococcygeal fibers of the levator ani muscles, and this permits a general sagging of the vaginal walls. However, the most important factor in the formation of cystocele is incompetency of the pubovesicocervical fascia. This broad

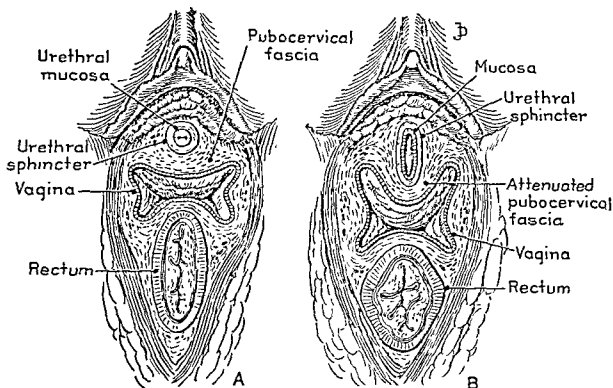


FIG. 77. (A) Schematic representation of camera-shutterlike action of normal urethral sphincter. (B) Schematic representation of failure of urethral sphincter to close on straining after development of urethrocele.

structure extends as a sheet downward from the cervix between the vaginal wall on one side and the bladder and the urethra on the other. As with urethrocele, cystocele may develop shortly after delivery, but often it does not appear for a decade or more after childbirth. The deterioration of tissue with age, as well as with the strain of daily life, is undoubtedly a factor in the formation of a cystocele years after childbirth. One rarely sees a cystocele in a nulliparous woman.

When there is a cystocele of considerable size the woman may complain of a bearing-down sensation in the vaginal region, and often there is the annoying feeling of a bulging, protruding mass. She frequently believes this to be her "womb," when the protrusion is actually the cystocele. Coupled with this there is often, although not always, an urgent and frequent desire to urinate when standing or walking. These urinary symptoms may be present when the urine is quite free from infection, but the absence of infection must be proved by the microscopic examination of a catheterized specimen of urine and not taken for granted. Frequently, the urine is

infected as a result of incomplete emptying of the bladder when a large cystocele permits the lowermost portion of the bladder to drop to a level below that of the internal sphincter. Cystitis, developing from this, aggravates the vesical irritability which often is already present without infection. When such an infection is present, a preoperative trial of sulfatherapy should be given in an attempt to clear up the infection before surgical treatment of the cystocele is undertaken. A pessary may be used to support the bladder while this chemotherapy is in progress, thus reducing the amount of residual urine and increasing the probability of successful eradication of the infection. When the infection has been long standing, it may fail to clear up preoperatively, and much time may elapse after operation before the bladder becomes free of infection and the patient free of bladder irritability.

#### TREATMENT

The treatment of urethrocele and cystocele is surgical. Occasionally, when surgery is contraindicated or must be deferred, the

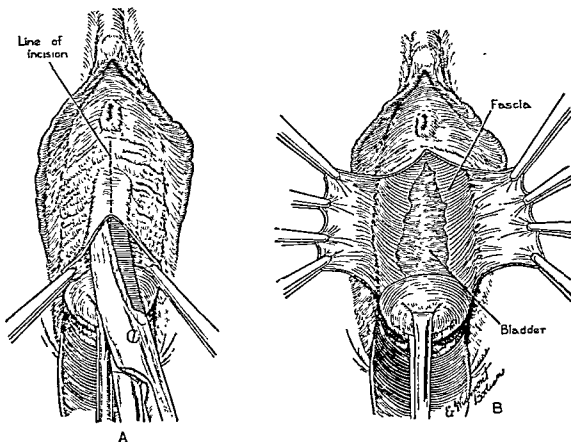


FIG. 78. Radical repair of cystocele. (A) An inverted T-shaped incision is made through the anterior vaginal wall. Vaginal mucosa is separated from the bladder by alternately opening and closing curved scissors. (B) Flaps of mucosa have been dissected laterally. The fascia has been dissected from the mucosa and left attached to the bladder.

patient can be made comfortable with a ring pessary. Since cystocele and urethrocele so frequently occur together, the operations for both conditions are often combined. The most essential step in the cure of these two conditions is restoring support to the urethra and/or the bladder by proper use of the pubovesicocervical fascia. The technic of the operation for cystocele follows. The technic of the operation for urethrocele is given in connection with stress urinary incontinence, since this is the symptom for which operation is done most often.

#### TECHNIC: REPAIR OF CYSTOCELE

The patient is placed on the table in the lithotomy position, and traction is made on the anterior lip of the cervix by means of a

Jacobs clamp. An inverted T-shaped incision is made through the anterior vaginal wall. The transverse cut is first made at the reflexion of the vaginal mucosa onto the anterior lip of the cervix. A curved Mayo scissors is then inserted through this transverse incision and made to tunnel upward (Fig. 78 A). If there is no urethrocele it is best to stop the incision short of the urethra, for the scar which forms about the sphincter region occasionally keeps the sphincter from closing normally, and partial incontinence may result. The plane of cleavage which the scissors enters is between the pubovesicocervical fascia and the bladder. After the tip of the scissors has passed a few centimeters, the mucosa is cut in the mid-line. The alternate tunneling and cutting are continued until

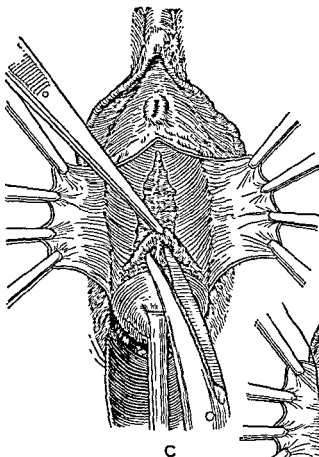
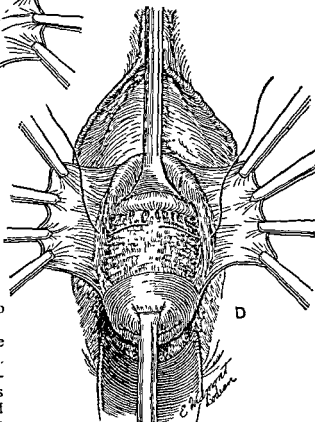


FIG. 78 (Continued). Radical repair of cystocele. (C) Attachment of bladder to cervix is being cut. After a few snips with the scissors the bladder usually can be dissected up by blunt dissection. (D) The bladder has been well advanced, exposing pillars of pubovesicocervical fascia. The first suture has been placed which will approximate pillars in front of cervix.



the urethral meatus is reached if there is also a urethrocele.

The edges of the vaginal mucosa are grasped with Kocher clamps and retracted. Using the scalpel, a separation of the pubovesicocervical fascia from the mucosa flaps is started. Then the dissection is continued with gauze. In this way the fascia is left attached to the bladder, except for an area in the mid-line (Fig. 78 B). This ensures a good blood supply to both the fascia and the subjacent bladder.

The bladder is picked up with a smooth forceps and separated from its attachment to the cervix. After a few snips with the scissors the bladder can usually be pushed up with the gloved finger (Fig. 78 C).

Holding the bladder up with a slender retractor causes the lateral portions of the fascia to stand out as pillars. The fascia pillars are brought out together in the mid-line and sutured to the cervix by 2 or 3 interrupted sutures of No. 0 chromic catgut (Fig. 78 D).

After completion of this step, the bladder will be well advanced from its former low attachment to the cervix. The closure of the remainder of the hernial gap is completed by bringing together the fascia in the mid-line, beneath the base of the bladder (Fig. 78 E). If there is the co-existence of a urethrocele, the fascia is approximated in the mid-line beneath the urethra.

Figure 78 F shows the entire hernial opening strongly closed with broad sheets of fascia. The excess of mucosa of each vaginal flap is excised.

In making the final closure of mucosa,

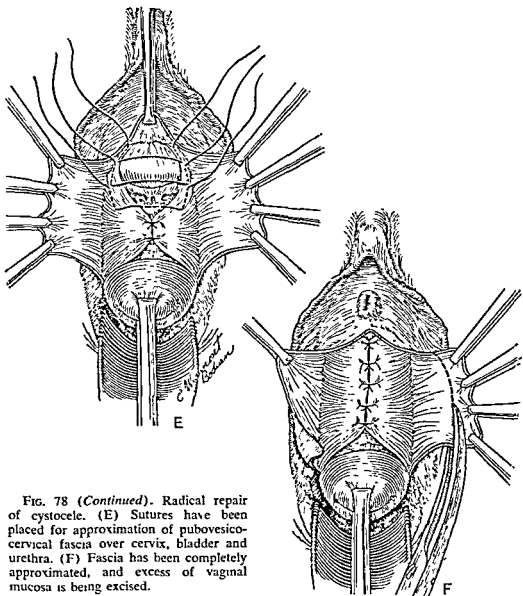


FIG. 78 (Continued). Radical repair of cystocele. (E) Sutures have been placed for approximation of pubovesico-cervical fascia over cervix, bladder and urethra. (F) Fascia has been completely approximated, and excess of vaginal mucosa is being excised.

often it is wise first to approximate the mucosa at the cervical end. In doing this a bite is taken in the cervix in the mid-line (Fig. 78 G). The fixing of the mucosa at this point, leaving the suture long and making traction, serves to line up the edges of the incision for closure. The operation is completed by approximating the mucosal edges with interrupted sutures of No. 0 chromic catgut in the mid-line and laterally at the cervix (Fig. 78 H).

#### REPAIR OF CYSTOCELE WITH VAGINAL HYSTERECTOMY

In repairing a cystourethrocele at the time of vaginal hysterectomy, it is done in the routine manner as described elsewhere in this chapter, except that there is no cervix to "bite" into, in approximating the pubocervical fascia. There are instances in which there is no urethrocele, and it may be advantageous to do the high cystocele repair "in reverse," from the apex of the vagina downward.



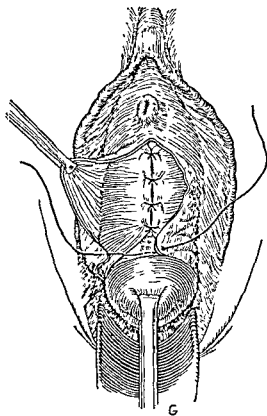
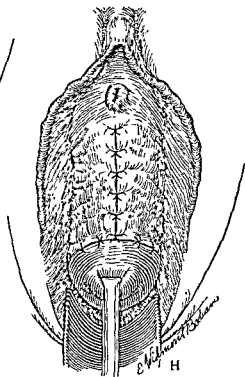


FIG. 78 (Continued). Radical repair of cystocele. (G) First suture is being placed for approximation of vaginal flaps. Note that it bites through the anterior wall of the cervix. (H) Operation completed.



**Technic.** After completing the hysterectomy and suturing the ligament to the vagina, the peritoneum is closed. An inverted V-shaped incision is made with the broad base of the triangle formed by the transverse incision at the top of the vagina (Fig. 79 A). After denuding the mucosa from this area, the pubocervical fascia is dissected free from the mucosa on either side as shown in Figure 79 B.

The stumps of the ligaments are brought together as shown in Figure 80 A, biting into the posterior vaginal wall, thus obliterating the space through which an enterocele might form. The pubocervical fascia is then approximated in the mid-line with sutures as shown in Figure 80 B. Figure 81 A shows all these sutures tied except the last one, and the assistant is inverting the bladder wall as the final suture is tied. Thus the fascial support of the bladder is restored. Further trimming of the vaginal mucosa is done as necessary, and the vagina is closed longitudinally with interrupted sutures, as shown in Figure 81 B.

## STRESS INCONTINENCE OF URINE

The most frequent form of incontinence of urine in women is that known as stress incontinence. Usually it first manifests itself by the escape of a few drops of urine following unusual exertion. There is a tendency for the incontinence to become exaggerated, and soon there is a gushing of urine on coughing, sneezing, laughing, stooping or even walking. If it is not treated, the incontinence may become almost complete. Howard A. Kelly first wrote about the condition in 1911 and described a method of treating it which has proved to be quite

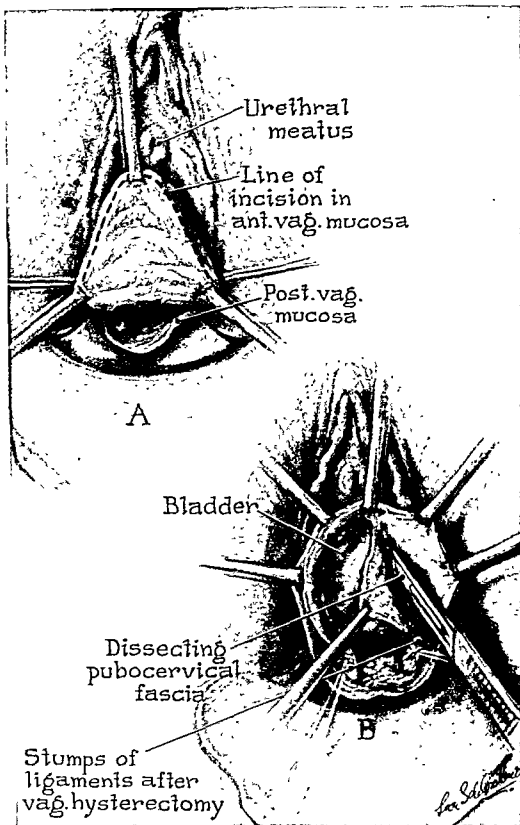


FIG. 79. (A) Incision is made as shown in dotted line, and this mucosa is denuded. (B) The pubocervical fascia is dissected free from the mucosa laterally.

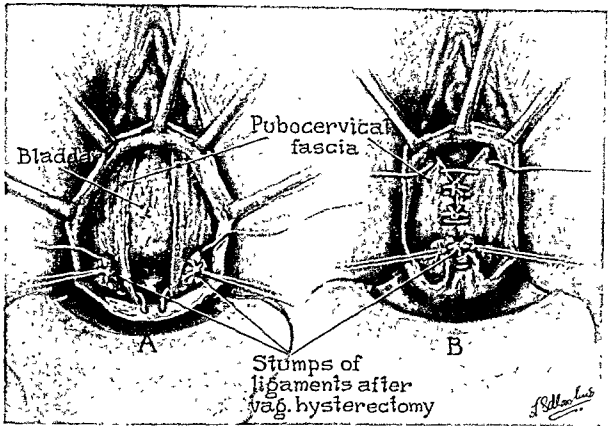


FIG. 80. (A) The stumps of the uterine ligaments which were previously sutured to the vagina are brought together, biting into the posterior flap of mucosa to obliterate the space and prevent an enterocele. (B) Pubocervical fascia is being brought together in the midline, with mattress sutures of No. 0 catgut.

satisfactory; we continue to use it today with some modifications. We shall quote directly from Kelly's original article:

There is a peculiar form of incontinence of urine in women which either follows childbirth or comes on about middle age and is not associated with any visible lesion of the urinary tract. Sometimes the most suggestive picture that can be seen by a cystoscope is a gaping internal sphincter orifice which closes sluggishly. In the incontinence which comes on at about 40 years or over the patient usually first notices the occasional escape of a few drops of urine as she makes some unusual exertion. This grows worse until, at last, a little urine runs out whenever she coughs, laughs, sneezes, lifts anything or steps up high. The condition may finally become so bad that the underclothes are constantly wet and soiled with the malodorous secretions.

For a long time surgeons have tried to relieve this condition by a variety of operations, some of them more or less bizarre, designed

to act upon the external urethral orifice by contracting it, or to resect the vagina at the internal orifice, or to kink the urethra, or in one way or another to compress it. The operations rarely succeed. I have seen many patients subjected to them, but none relieved.

The key to successful treatment lies at the internal orifice of the urethra and in the sphincter muscle which controls the canal at this point. For the past 10 or 12 years I have been operating constantly upon patients suffering from this minor distressing incontinence and I have succeeded in relieving every case where there had not been a destruction of the tissues at the urethral orifice, that is, where there had been no vesicovaginal fistula with sloughing.

The operation which I do is as follows (Fig. 82): A Pezzer catheter is introduced into the urethra; the tube ought to be small, not over 5 mm. in diameter. With the patient in the lithotomy position, the posterior wall of the vagina is retracted, and the area at the neck of the bladder is brought down with either forceps or four guy sutures.

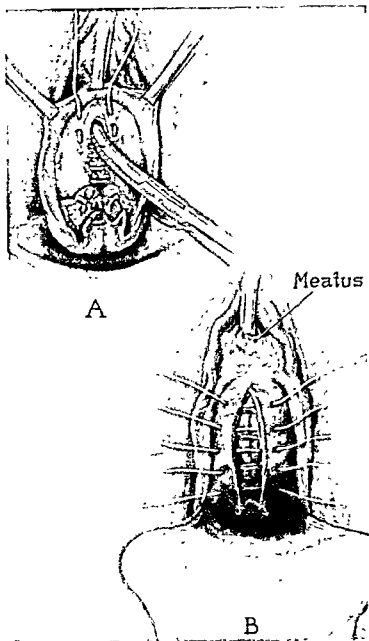


FIG. 81. (A) The last opening in the fascia is closed, inverting the bladder with a Kelly clamp. (B) After excising any redundant mucosa, the vaginal incision is closed with interrupted catgut sutures in the midline.

The next step is to slit the vaginal wall down to the urethra and the bladder in the median line for about  $1\frac{1}{2}$  to 2 inches. The neck bladder should fall at about the center of the incision. The position of the neck is easily determined at all times by moving the catheter to and fro and feeling its head, which presses close up against the urethra. The utmost care should be taken not to cut the urethra or the bladder at any step of the operation. After making this median incision the vagina is further dissected

off on both sides with tissue forceps and dissected away from a distance of 2 to  $2\frac{1}{2}$  cms. around the neck of the bladder. This dissection may be made with blunt-pointed scissors which push their way into the tissues, separate the bladder from the vaginal walls, and then cut the connecting fibrils. The dissection should be deepest at the neck of the bladder.

When the detachment of the vagina from the bladder is completed, the finger should be able to grasp at least one half or two thirds

of the neck of the bladder, including continuous urethra. Sometimes the bladder wall is so thin that its mucosa shines through.

The next step is to suture together the torn or relaxed tissues at the neck of the bladder, using 2 or 3 mattress sutures of fine silk or linen passed from side to side. The first suture taking in about 1½ cms. of tissue is tied at once, when the succeeding suture may be passed outside this, further contracting and bringing together the tissues at the neck (Fig 82). This is the principal part of the operation, and when done the mushroom catheter ought to be pulled out, the head of the catheter escaping with a little jump as it clears the tightened reconstructed sphincter at the neck of the bladder. The more or less redundant vaginal walls, which have been detached in order to expose the sphincter area, are now resected so that the remaining tissues can be snugly brought together from side to side, so as to support the vesical area operated upon and avoid any dead space between bladder and vagina. I prefer to do this suturing with a continuous fine catgut suture in one or two layers.\*

In 1914 Kelly and Dumm reported on 20 cases upon whom the senior author had operated. In 16 the operation was successful.

The above quotation is from a paper which we regard as a milestone in the history of the treatment of stress incontinence. However, since the publication of this paper, we have made some observations which we regard as important to an understanding of the different types of stress incontinence which should be recognized in order that they may be treated effectively. In this connection we should warn of the occurrence of partial urinary incontinence which is caused by an irritating lesion within the bladder, the ureter, or a kidney. In some instances the desire to void is so frequent and urgent that there is a loss of control with the intense desire to void, and the wearing of a pad for protection becomes necessary. This is urge incontinence and should be differentiated from the type of incontinence considered here. When such a condition is suspected, the patient should undergo a complete urologic investigation, and when the intrinsic

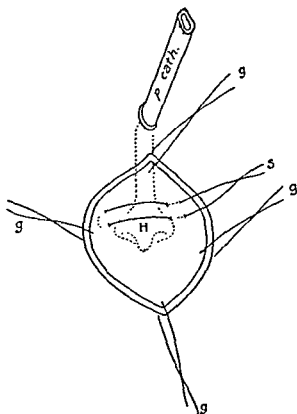


FIG. 82. Original Kelly diagram of vesical sphincter plication. H is the head of the catheter marking the neck of the bladder. gggg are the guy sutures holding the wound open. S is the suture at the neck of the bladder reuniting the sphincter muscle.

urologic lesion is discovered, treatment should be directed at it.

The cases of true stress incontinence may be divided into four groups:

1. Those cases associated with a urethrocele or cystourethrocele.
2. Those cases following childbirth or previous surgery of the anterior vaginal wall but unassociated with demonstrable urethrocele or cystourethrocele.
3. Those cases occurring in nulliparous women, in which no defective innervation to the urethra or the bladder can be demonstrated.
4. Cases resulting from improper use of the resectoscope upon the vesical neck.

The cases associated with urethrocele or cystourethrocele form the largest group and fortunately, in this group the operative re-

\* Kelly, Howard A.: Incontinence of urine in women. *Urol. & Cut. Rev.*, 17:291.

sults are almost uniformly successful. The mechanism, whereby the vesical sphincter fails to remain closed when the woman increases her abdominal pressure, is dependent upon the sphincter fibers of the vesical neck and the urethra being pulled down with the vaginal wall. Thus the concentric closure of the circular fibers is prevented (Fig. 77). In this group it is important to bring together the pubovesicocervical fascia in the mid-line to support the urethra and the bladder base after the sphincter fibers of the vesical neck and the urethra have been tightened. In fact, many of such cases could be cured by a properly performed operation for cystourethrocele without a sphincter plication, but if there is an appreciable degree of incontinence, plication more certainly assures success. It is our custom, in all of the cases in which we plicate for incontinence, to plicate from the internal sphincter region forward for the entire length of the urethra. Circular muscle fibers are found for the full length of the urethra and may be used to advantage in restoring bladder control.

In the second group of cases, where there is no demonstrable urethrocele or cystourethrocele, the incontinence depends upon scarring which has resulted from the obstetric injury or previous surgery of the anterior vaginal wall. If one does a sufficient number of operations for cystocele on women without preoperative stress incontinence, sooner or later one will encounter a case in which stress incontinence follows the surgery. As a result of scar tissue forming in the sphincter region, the muscle is prevented from closing normally. When the sphincter action is observed from within through a Kelly cystoscope, incomplete and irregular closure may be observed, because the sphincter is prevented from a normal concentric closure by the scars. One also may see this same picture through the cystoscope in cases of the first group after an unsuccessful attempt at repair. In repairing this condition we have had some success by dissecting more completely around the circumference of the urethra, perhaps two thirds of the way, leaving only the superior attachment of the urethra intact before plicating the urethra. In this manner an attempt is made to release scars which prevent complete sphincter closure.

However, one is not always successful in restoring continence by this operation, and in recent years we have treated this group of cases with some type of Goebell-Stoeckel operation, especially if the incontinence is marked.

There is a third group of women who have stress incontinence, who have had no children and in whom no faulty nervous mechanism can be demonstrated. These women are usually elderly, but on rare occasions we have seen the condition in young, nulliparous women. In elderly women there is apparently a loss of muscle tone, although the cause of this is not clear. In this multiparous group a plication of the sphincter and the urethra for its full length is done with success in some instances, but the results are not as satisfactory as in the group in which the incontinence results from childbirth. Therefore in this group we have recently performed a Goebell-Stoeckel type of operation as the primary procedure when the incontinence is marked.

There is yet a fourth group of women who have stress incontinence resulting from the use of the resectoscope on the female vesical neck. In 1921 John R. Caulk reported on the treatment of contracture of the vesical neck in women by means of the cautery punch. Later, Folsom became very enthusiastic about the procedure for a condition which he referred to as female prostatism. From his writings one gets the impression that he considered female prostatism almost as frequent as the disease in the male. He even regarded some of the tissue removed by the resectoscope as being histologically consistent with prostatic tissue. The author had the opportunity of examining some of this tissue and could not concur in this diagnosis. As a result of his writing, urologists have more and more been using the resectoscope in the region of the vesical sphincter, chiefly in cases of chronic urinary infection associated with some residual urine. In our experiences in female urology at Hopkins we have failed to find the need of using the resectoscope at the vesical neck in women except in a few cases of neoplastic involvement from pelvic malignancy. However, we have encountered valves in the female urethra in children with persistent urinary tract

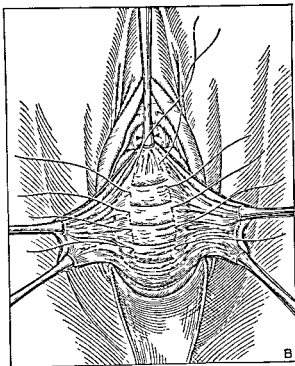
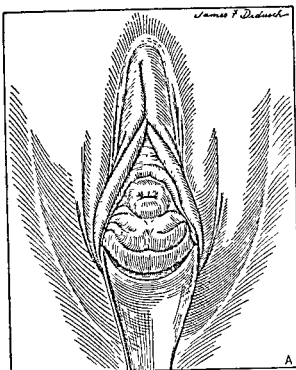
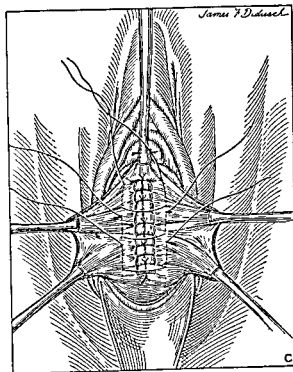


FIG 83. Operation for urethrocele and stress incontinence of urine. (A) Shows urethrocele which was responsible for the stress incontinence. (B) A mid-line vaginal incision has been made about 4 cm. in length extending back from urethral meatus. Mattress plication stitches have been placed. (C) The entire urethra and sphincter region has been plicated with mattress sutures of medium silk. These sutures narrow the urethra and tighten the sphincter. A second row of slightly coarser stitches is placed through the fascia.



infections as reported by Brack which are removed successfully by the resectoscope. Urologists have been using the resectoscope with increasing frequency, and we as gynecologists are seeing an increasing number of incontinent women from this procedure. In some instances the incontinence is of the stress type, and in others it is constant and almost complete. In a few cases there have actually been fistulas at the sphincter region. In 1948 Everett reported 5 cases of incontinence resulting from this procedure, and we have seen several more since them.

#### TECHNIC: OPERATION FOR URETHROCELE AND PPLICATION OF VESICAL SPHINCTER FOR STRESS INCONTINENCE OF URINE

Figure 83 A shows the urethrocele for which this operation is done. The bulging is confined to that part of the vagina beneath the urethra and the trigone of the bladder.

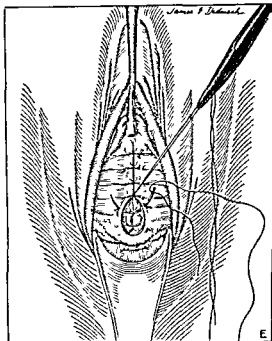
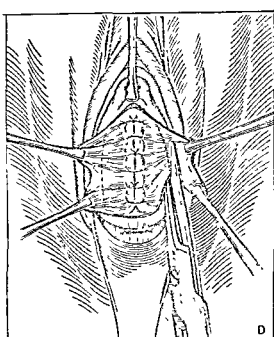


FIG. 83 (Continued). Operation for urethrocele and stress incontinence of urine. (D) The fascia sutures have been tied, giving support to the urethra. Excess of mucosa is excised. (E) Vaginal incision is closed in the mid-line.

There is no herniation whatever of the bladder beyond the region of the trigone.

After making a mid-line incision through the vaginal mucosa extending from the urethral meatus as far back as the urethrocele extends, the flaps of mucosa are dissected laterally. Beginning less than a centimeter from the urethral meatus, a succession of mattress sutures is taken as indicated in Figure 83 B. These bites of tissue are taken on each side of the urethra and parallel with it. For these delicate sutures, medium silk and a thin curved needle should be used. The sutures are carried back to the trigonal region, past the point of junction of the urethra and the bladder. This internal sphincter region is usually about 3 or 4 cm. from the urethral meatus. It may be located exactly by inserting a mushroom catheter in the bladder and withdrawing it, noting the point where it meets obstruction as it jumps through the internal sphincter. After the internal sphincter region has been identified, the catheter should be withdrawn before tying the sutures because its presence in the urethra interferes with the tightening of the

sphincter and the urethral tube. It is our practice to tighten the entire urethral tube in addition to the internal sphincter region as originally described by Kelly, for there are circular muscular fibers around the urethra throughout its entire length, and advantage should be taken of these in improving the sphincter action. As these sutures are tied, the tissue between them is inverted by an assistant who makes slight pressure over the urethra in the mid-line with a Halsted clamp inserted from above as each suture is tied.

After this first layer of mattress sutures has been tied a second row of mattress sutures is placed as indicated in Figure 83 C. This second layer approximates fibers of the pubovesicocervical fascia and forms a support upon which the urethral tube rests. No. 00 chromic catgut is used for this, and larger bites of tissue are taken than when placing the first row of plicating sutures (Fig. 83 C). If, as in the case illustrated, 5 bites are taken to plicate the span of the urethra and the sphincter, perhaps the fascia covering that same span can be brought together in 3 bites.



After this second layer has been tied, the excess of vaginal mucosa is excised (Fig. 83 D). Then the mucosa is approximated in the mid-line with interrupted stitches of No. 00 chromic catgut (Fig. 83 E). It is a good plan to pick up a bite of the sub-jacent fascia with a few of these sutures to close any possible dead space beneath the mucosa.

This operation may be done alone or in combination with the operation for cystocele.

### RESULTS

The plication operation as above described has been used extensively by us with generally good results. Ninety per cent of the patients reported complete continence; 5 per cent were improved; and 5 per cent unimproved.

When this follow-up was done, many of

the patients had been operated upon several years before, but others only recently. Counseller found that the percentage of successes declined to 70 with the passage of time. We have no figures on this phase of the subject, but it is true that it is not uncommon to encounter patients who have developed some degree of leakage after years of continence from plication. In this connection we should mention Kegel's reported success with perineal exercises. He has devised and used a perineometer, an instrument for registering muscle contractions and restoring tone to the vagina. Our experience with this has not been great. We have not found many women very enthusiastic about practicing perineal contraction for 20 minutes 3 times a day as recommended by Kegel. Our patients have preferred to have the relative minor surgical procedure done with an excellent prospect of success.

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# Urinary Incontinence Not Curable by Sphincter Plication

## GENERAL CONSIDERATIONS OF ETIOLOGY AND TREATMENT

Although a great majority of cases of stress incontinence of urine can be cured by plication of the sphincter and the urethra as described previously, there are some failures, and one must look to another method for curing them. Especially is failure apt to result in those cases unrelated to child-birth injury where the poor sphincter musculature has insufficient tone to control the urine when the intravesical pressure is raised. Often failure with the plication operation in good hands is the result of previous bungling attempts with resulting scar tissue, making it impossible for the sphincter to contract adequately, regardless of how tightly it is plicated.

Congenital absence of sphincter mechanism associated with a completely formed urethral tube is rare but does occur. In such cases it is possible that circular musculature is present but uninnervated; however, there is no demonstrable evidence of other neurologic defects. Such cases cannot be cured by sphincter plication; consequently, some other type of mechanism for urinary control must be devised.

In another group of cases the urethra is congenitally defective or absent due to variable degrees of epispadias. The formation of a urethral tube is of no value unless some sphincter mechanism can be devised.

Destruction of all or part of the urethra by obstetric injury necessitates the construction of or the repair of a urethra, but often in such cases one is unable to repair the sphincter musculature sufficiently to restore continence.

Finally, there is a group in which the incontinence depends upon faulty enervation. The commonest congenital defect in the nervous mechanism is found in connection with spina bifida. Among the acquired lesions are: cord tumor, tabes dorsalis, transverse myelitis, multiple sclerosis and traumatic lesions of the cord. It is important to obtain as much data as possible upon the exact nature of the nerve defect in order to attempt intelligent correction. Kennedy devised an instrument for taking urethrograms which demonstrates the degree of sphincter failure. Barnes obtained satisfactory information by using a device simpler than Kennedy's. It was formed from 2 finger cots connected with a reservoir of strong sodium iodide. The bladder is filled with 180 cc. of 8 per cent sodium iodide solution, after which the balloon is placed in the urethra. The pressure in the balloon is maintained at 35 cm. of water. Weakness of the urethral sphincters is demonstrated by their inability to compress the balloon. This can be demonstrated by roentgenograms. By varying the pressure in the balloon and noting the ability of the sphincter to compress it, the exact degree of sphincter action is demonstrated.

One should be very careful in selecting cases for surgery with neurologic disease. Cystometric studies should be made to determine the intravesical pressure, since increased intravesical pressure may give rise to incontinence when the sphincter mechanism is normal. If sphincter tone is demonstrated to be normal, and if the intravesical tone is increased, obviously no surgical procedure directed at the sphincter will be of any value. Also, if a cystogram shows reflux

up the ureters, indicating faulty valve action at the ureterovesical junction, probably it is poor judgment to attempt to give that individual a vesical sphincter. We have learned from experience with a few such cases that obstructing the outflow of urine from the bladder may result in too much back pressure on the kidneys and predispose the patient to recurring attacks of pyelitis. On two occasions we were forced to break down the newly formed sphincter to stop the recurring attacks of pyelitis. Of course, in all neurologic cases an attempt should be made to correct the underlying condition, but unfortunately this is often impossible.

In all of the above groups of cases the surgeon must seek elsewhere than the vesical neck and the urethra to create a mechanism effective in the control of the urine. Many operations have been devised, none of which has been universally successful, although some can be used to advantage in certain cases. A short summary of these attempts may be useful to the student of incontinence of urine in women.

### HISTORICAL DEVELOPMENT OF OPERATIVE PROCEDURES

In 1907 Giordano utilized a portion of the gracilis muscle to encircle the urethra. Deming, in 1926, reported that he restored continence by this means in a woman in whom a urethral tube had been constructed previously because of epispadias.

In 1910 Goebell described an operation whereby he dissected free the pyramidalis muscles, brought them down posterior to the symphysis and encircled the urethra near its junction with the bladder. He suggested crossing the muscles if their length permits. He reported one case in which this operation was done after constructing a urethra in a child suffering from epispadias. A second operation of this type was done on a 2-year-old child who was incontinent following an operation for meningocele. In both cases the results were reported as satisfactory. An obvious difficulty with this operation lies in the fact that the pyramidalis muscles vary greatly in their development and may be too short to encircle the urethra.

In 1911 Squier utilized the transversus perinei and the levator ani muscles to restore

continence to a man whose sphincter had been cut at a previous surgical operation. He reported success. Taussig also utilized the right levator ani muscle in a case in which the urethra had been destroyed at delivery. A flap of vaginal mucosa has turned forward for the formation of a new urethra. A portion of the right levator ani muscle, which had been dissected free, was transposed beneath the base of the bladder and sutured to the left pubic fascia. A purse-string suture was placed about the urethra, picking up the levator fibers so that when the purse string was drawn tight, muscle fibers were drawn in a crescentic form beneath and partially around the urethra.

In 1914 Frangenheim utilized the pyramidalis muscle with an attached strip of fascia from the sheath of the rectus to encircle the male urethra. The strap was brought down retropubically around the urethra and was sutured to itself. The operation was done for incontinence following a perineal injury with stricture formation. The result was reported as perfect.

In 1917 Stoeckel combined the use of the pyramidalis muscle and the fascia strip with a plication at the sphincter region. He first dissected from the mid-line a strip of fascia with the pyramidalis muscles attached. The distal portion of the strip was split and brought down retropubically to the urethral region. The split ends were made to encircle the urethra and were sutured together below the urethra. He reported 2 cases treated successfully. In the first case a fistula had resulted from a vaginal cesarean section. After closure of the fistula the patient was still incontinent. By combining sphincter plication with the use of the pyramidalis muscle and the fascia strip, the patient was cured. The second case was one of a urethrocyстоcele associated with incontinence. The combination operation resulted in cure.

In 1932 Norman Miller modified the technic of the Goebell-Frangenheim-Stoeckel operation by bringing the pyramidalis muscle fascia strip down to the urethra anterior to the symphysis. He simply carried the mid-line incision down over the symphysis and buried the strip beneath the skin and the fat (Fig. 84 A, B). Like Stoeckel, he split the end of the fascial strip and united the

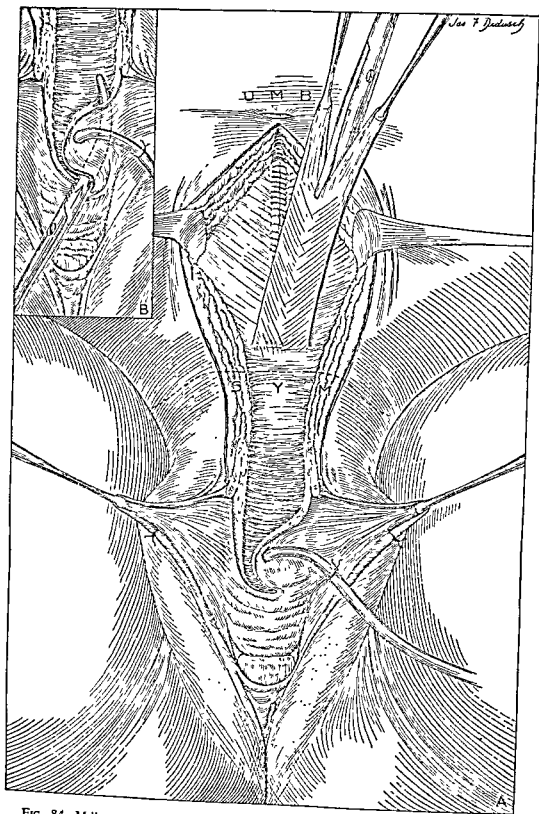
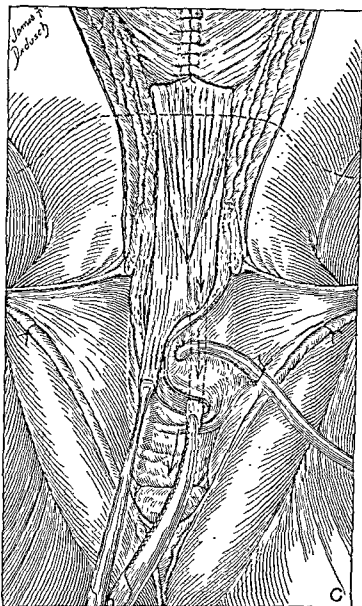


FIG. 84. Miller modification of Goebell-Frangenheim-Stoeckel operation. (A) The strap has been freed and split. The mid-line incision has been carried over the symphysis to the urethral region. (B) The tunnel about the urethra has been completed by blunt dissection with a Kelly clamp.

FIG. 84 (Continued). Miller modification of Goebell-Frangenheim-Stoeckel operation. (C) The strap of fascia has been turned down over the symphysis, the split ends being drawn about the urethra.



ends beneath the urethra (Fig. 84 C). The purpose of Miller's modification was to avoid "bleeding and excessive manipulation necessary in bringing the muscle-fascia strip down behind the symphysis." We never have experienced any difficulty in bringing the fascia strip down behind the symphysis when the technic illustrated on pages 190 to 193 was used. There seems to us to be a decided advantage in placing the strip retropubically, for by so doing the strip has a direct pull on the vesicourethral junction rather than on the more distal part of the urethra. This is very advantageous when the urethra is short, as it sometimes is, following reconstruction by a plastic procedure.

In 1933 Price reported the cure of urinary incontinence in a girl with congenital absence of the sacrum and the coccyx and without enervation of the sphincter. He used a sling of fascia lata which he brought around the urethra retropubically and then attached both ends to the rectus muscles.

In 1942 Aldridge devised a new procedure which combined some of the points of the Goebell-Frangenheim-Stoeckel operation with those of Price's. Making a transverse lower abdominal incision, he developed strips of aponeurosis from the rectus sheath on both sides, directing his incisions for the securing of these fascia strips outward and upward (Fig. 85). These fascia strips were

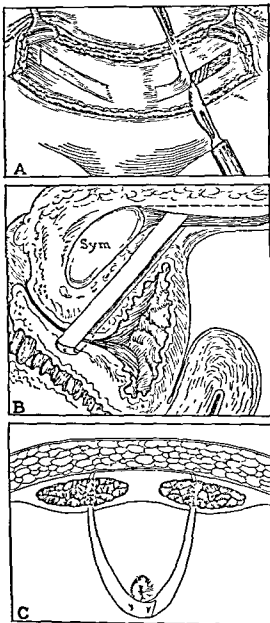


FIG. 85. Aldridge modification of Goebell-Frangenheim-Stoeckel operation for urinary incontinence. (A) The fascial strips are being separated through a Pfannenstiel incision. (B) The fascial strips are shown in position around the posterior portion of the urethra. Dotted line indicates position of rectus muscles when contracted. (C) Diagram indicating slinglike action of the fascial strips.

brought down through the rectus muscles, then retropubically, finally encircling the urethra. He depended upon the elasticity of the

rectus muscles to afford the proper pull on the urethra.

Shearer and Te Linde, following Price's suggestion, have several times used a strip of fascia lata obtained from the patient with a fascial stripper. This has proved to be very useful in cases in which it was not feasible to use abdominal wall fascia. In fact, in recent years we have used the fascia lata more and more. It is usually stronger fascia than that obtained from the rectus sheath.

In 1949 Wilfred Shaw, of London, described an operation in which a broad strip of fascia lata is transplanted beneath the entire length of the urethra and bladder base. Holes are drilled through the pubic bones bilaterally, and the ends of the fascial slings are pulled through these holes. The ends of the sling are sutured with catgut to the tendinous tissue in the vicinity of the holes, with the desired amount of tension on the sling. He reports 51 persons operated upon by this method with one death. Thirty-five of these patients with simple stress incontinence were cured.

In the same year Marshall, Marchetti and Krantz reported an entirely new operation which they had carried out on 50 patients, 38 with the usual type of stress incontinence, 25 of whom had had a total of 40 standard gynecologic operations without relief. The procedure consisted of simple operative elevation and fixation of the vesical neck and the urethra by suturing them to pubic and rectus muscles by the suprapubic route with chromic catgut. Figure 91 demonstrates the operation quite clearly. They report 82 per cent of the cases as having excellent results.

Within the last year we have done the sling type of operation 10 times, using a 5-mm. ribbon of mersilene, a polyester fiber commonly known as Dacron. In both laboratory animals and in the human this material has been shown to cause a minimum of tissue reaction. In one of our cases an abscess formed, but the bladder had been punctured in this case, and the abscess probably was due to the extravasation of urine. In the other cases the mersilene seemed to serve as well as fascia for the sling. If future experiences substantiate our present impres-

sion, we shall use the mersilene in place of the fascia, and this will greatly simplify the operation. Our experience with it is not as yet extensive, but it appears to be so promising that we believe it should be included in this volume.

## CHOICE OF OPERATION

From the above short historical review it is apparent that the history of the surgery of incontinence is still in the making, and ideas are not completely crystallized. Nevertheless, by becoming familiar with the various procedures the surgeon has a number of tricks in his armamentarium which he can combine and by which he may fit his operation to the individual case.

In not a few instances it is well to combine one of the strap procedures with cystocele repair and plication of the suburethral fascia. When this is done it is well to complete first the suturing of the fascial strips beneath the urethra and then to bury them beneath the suburethral fascia. In this manner the transplanted fascial strips are less liable to infection from the vagina than if they lie more superficially.

When there is a scar of a previous mid-line incision one should not choose an operation requiring the use of a mid-line fascial strap. Similarly, when the lateral fascia is scarred by a broad rectus or McBurney scar the Aldridge lateral straps should be avoided. When a urethra has been made previously by a plastic operation and sphincter action is to be attempted, it is unwise to cut into the suburethral vaginal mucosa for fear of entering the urethral lumen. In such instances a single long strap of fascia from the mid-line or fascial lata may best be used in a U-shaped manner as indicated in Figure 90, whereby a tunnel is made between the vaginal and the urethral mucosa with a small thin-bladed knife.

Our experience with the Marshall, Marchetti and Krantz procedure is too limited to permit an authoritative opinion, but in the hands of the authors and a limited number of others it has been successful. It has the advantage of being done through one operative field.

The Marshall-Marchetti may be used for

stress incontinence as the primary operation when laparotomy is done for other reasons, thus sparing double exposure.

With increasing experience and success with the Aldridge modification of the Goebell-Frangenheim-Stoeckel operation we have favored it more and more. Our results have been quite successful except in some neurologic cases in which the operation was done early in our experience against indications which we now recognize.

The technics of the procedures that we consider most useful are given in detail below.

### TECHNIC: GOEBELL-FRANGENHEIM-STOECKEL OPERATION

The patient is placed on the table in a semilithotomy position so that she can be draped for work in the lower mid-line and, at the same time, in the vagina. The danger of infection is reduced, in our experience, by using the combination draping. The abdominal part of the operation is done first to avoid contamination from the vagina.

A mid-line incision through the skin and fat is made from umbilicus to symphysis. The sheath of the rectus is cleaned of fat for 1 or 2 cm. on either side of the mid-line. A strip of fascia, fully 1 cm. in width, is freed in the mid-line, leaving it attached to the lower end (Fig. 86 A). The pyramidalis muscles will be seen on the posterior surface of the lower portion of the flap and are left in situ.

At this stage of the operation it is a good plan to close the fascia incision and also the subcutaneous fat and skin, except at the lower end, in order to minimize the chances of infection of the mid-line incision. The skin incision is not shown closed in Figure 86 C for the purpose of orientation, but it is our custom to have closed the fascia and the skin at this stage of the operation.

The operator then transfers himself to the perineal operative field. A short mid-line incision is made through the vaginal mucosa over the posterior part of the urethra and the trigone. It is advisable to place some type of catheter into the urethra so that it can be palpated readily from time to time in

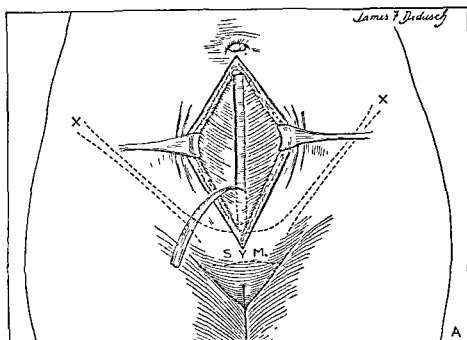
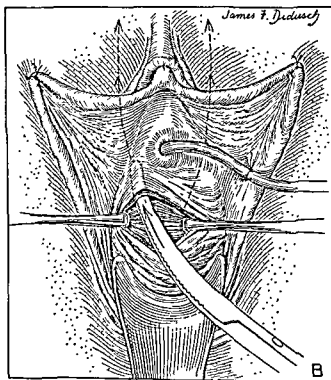


FIG. 86. Goebell-Frangenheim-Stoeckel operation for urinary incontinence. (A) A mid-line incision has been made, and a strip of fascia is excised. (B) A mid-line incision has been made through the vaginal mucosa, and the flaps dissected laterally. Arrows indicate direction of retropubic tunnels.





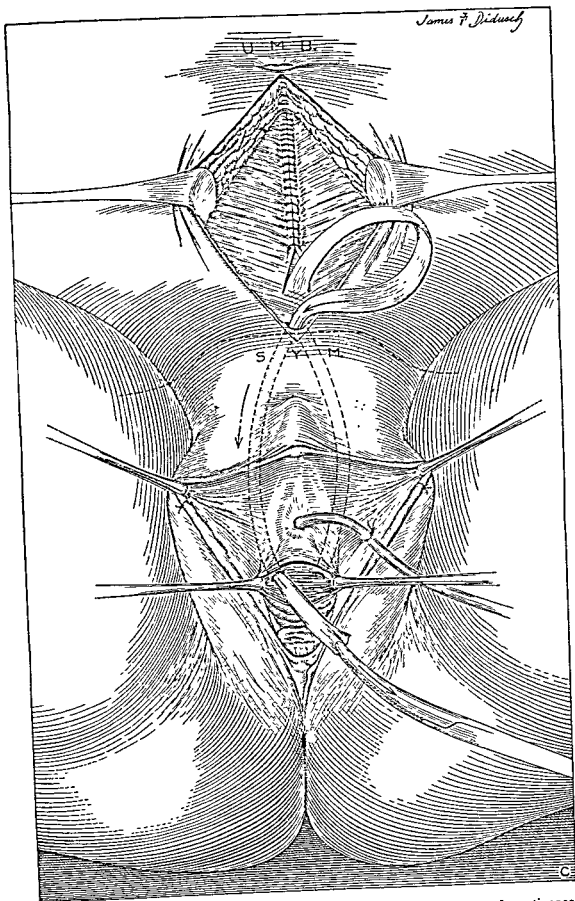


FIG. 86 (Continued). Goebell-Frangenheim-Stoeckel operation for urinary incontinence.  
(C) The strap of fascia has been brought down through one retropubic tunnel.

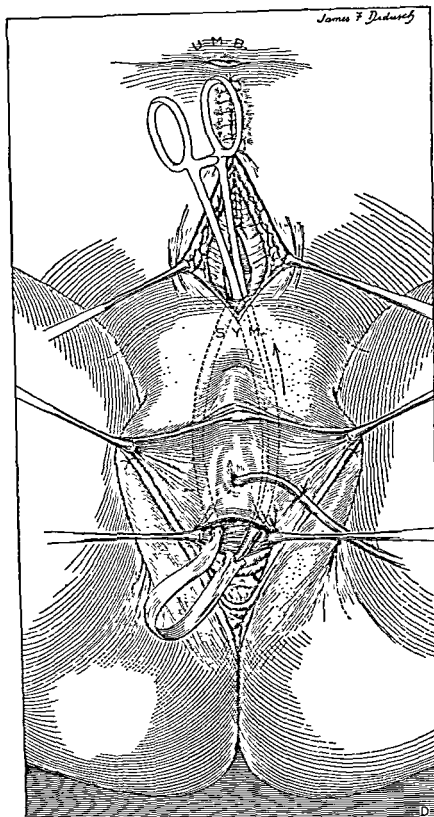


FIG. 86 (Continued). Goebell-Frangenheim-Stoeckel operation for urinary incontinence. (D) The strap of fascia is being drawn up through the other tunnel, thus encircling the urethra.

the course of the operation. Using a Kelly clamp, a tunnel is made on either side of the urethra and retropubically until it emerges at the lower end of the mid-line incision. Dur-

ing this procedure the tip of the clamp should be directed toward the symphysis and kept directly against the periosteum. If this is done, there is little danger of perforation of

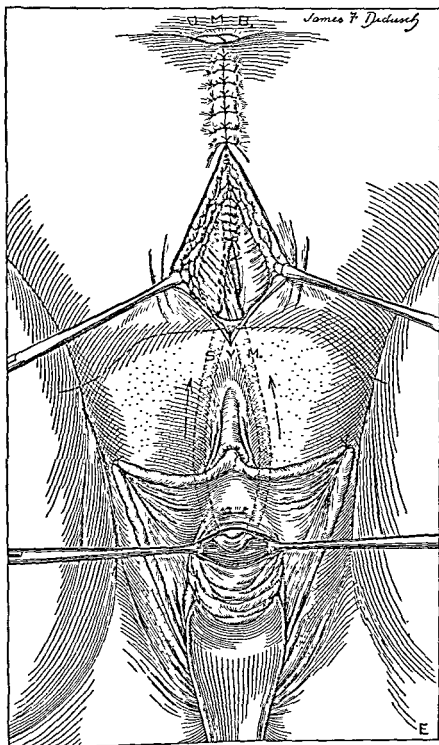


FIG. 86 (Continued). Goebell-Frangenheim-Stoeckel operation for urinary incontinence. (E) The strap has been drawn to the proper tension and sutured with medium silk to the fascia of the rectus.

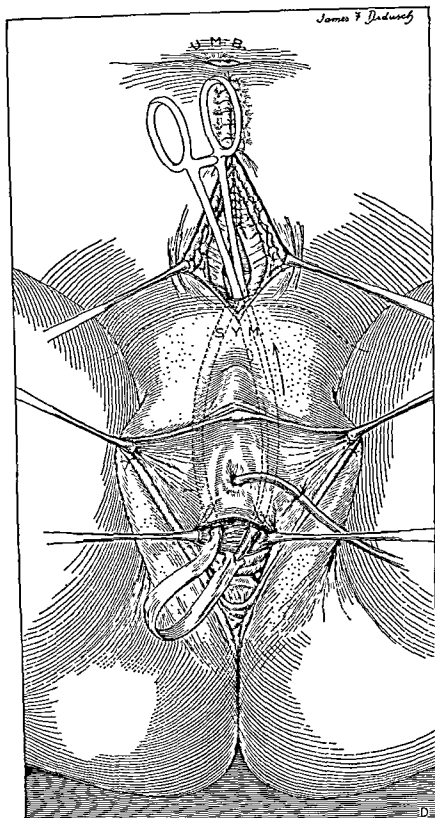
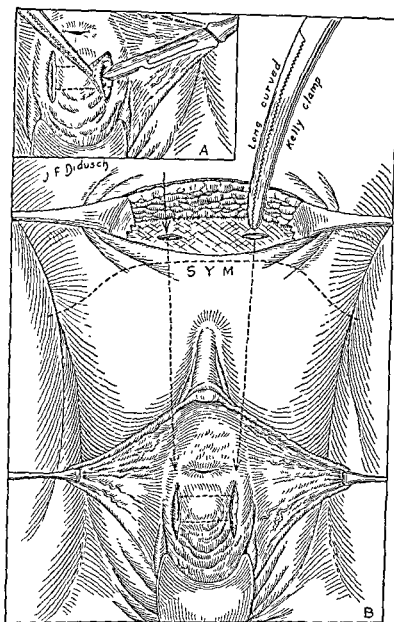


FIG. 86 (Continued). Goebell-Frangenheim-Stoeckel operation for urinary incontinence. (D) The strap of fascia is being drawn up through the other tunnel, thus encircling the urethra.

FIG. 87. Modified Goebell-Frangenheim-Stoeckel operation, using strip of fascia lata. (A) Two short slits are made on either side of the urethra, and a transverse tunnel is made between the urethral and the vaginal mucosa. (B) A short transverse suprapubic incision has been made, and the fascia has been punctured to permit the passage of a long Kelly clamp.



with difficulty by the blunt Kelly clamp, but a small cut with the scalpel directly over the point of the clamp permits it to perforate. Then the clamp is opened slightly, and a second clamp, similarly opened, is fed into the jaws from below. Both clamps are shut, and traction is made on the upper clamp as the lower clamp is pushed. Then the end of the left fascia strip is fed into the jaws of the lower clamp, and the clamp is withdrawn from below. This is repeated on the opposite side, and thus the ends of both strips are delivered beneath the urethra. The straps are overlapped slightly, any excess is cut

off, and the strips are sutured together with 3 or 4 interrupted sutures of medium silk. Care is taken to get the proper amount of tension on the straps to give the patient continence. This is tested by distending the bladder through a glass catheter and making moderate suprapubic pressure. If a cystourethrocele repair is to be done it is completed at this point, burying the fascia strips beneath the suburethral fascia. The excess of mucosa is excised, and the vaginal wound is closed with interrupted sutures of No. 0 catgut. The small mid-portion of the abdominal wound is then closed.

the bladder, and we never have encountered any serious hemorrhage (Fig. 86 B).

The end of the fascial flap is caught with the tip of the Kelly clamp and withdrawn down to the vaginal operative field through the retropubic tunnel on the left side (Fig. 86 C).

A large Kelly clamp is then inserted from above into the right-sided tunnel; the tip of the fascial strip is caught; and the clamp is withdrawn (Fig 86 D).

The fascial strip is then sutured with medium silk or linen to the sheath of the lower portion of the rectus (Fig. 86 E). It is essential to have the correct amount of tension on this strip before it is sutured. The bladder is filled with sterile saline solution before the catheter is withdrawn, and after withdrawal of the catheter pressure is made upon the bladder suprapubically and vaginally to test the strength of the newly formed sphincter. It should be able to resist reasonable pressure.

The lower portion of the abdominal incision is then closed.

An indwelling catheter is placed in the bladder at the time of operation and removed on the fifth day.

#### TECHNIC: ALDRIDGE MODIFICATION OF THE GOEBELL-FRANGENHEIM-STOECKEL OPERATION

The patient is placed on the table as described in the previous operation, except that the abdomen is draped for a transverse incision.

A semicircular transverse lower abdominal incision is made through the panniculus; the aponeurosis is cleared of fat over an area about 1 inch wide; and bleeding is controlled.

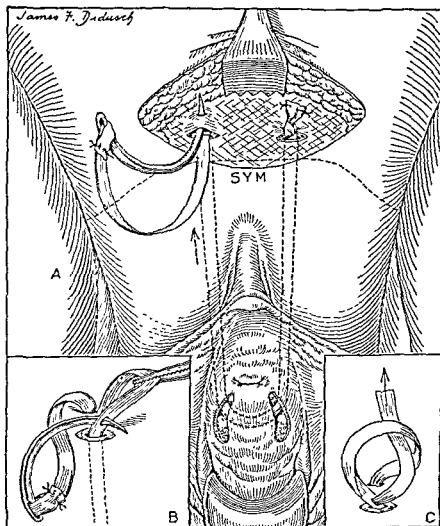
The strips of fascia are cut on either side of sufficient length to be carried down retro-pubically and encircle the urethra. The length of these strips, naturally, must be estimated and will vary, depending upon the width of the symphysis pubis, but if they are carried up to the level of the anterior superior spines of the ilia they will be of sufficient length, even though the symphysis is quite wide. The strips will be composed of the aponeurosis of

both external and internal oblique in the medial half, but the aponeurosis of the internal oblique laterally is replaced by muscle. Therefore, the distal portion of the strap will be composed of external oblique fascia only. The straps are separated from the subjacent muscle and thus mobilized down to their bases. The medial end of each strip is left attached at about 1.5 cm. from the mid-line (Fig. 85). The incisions in the aponeuroses are then closed with continuous sutures of No. 0 chromic catgut; the fat is approximated with interrupted sutures of triple zero chromic catgut; and the skin is closed with continuous fine silk, leaving a small unclosed space at the midportion of the incision. The fascia strips are placed in this space and covered with moist sponges. The closed portion of the abdominal wound is covered with sterile towels.

The operator is then seated for the vaginal portion of the operation. The labia minora are sutured laterally for good exposure, and posterior retractor is placed in the vagina. An Allis clip is placed in the urethral meatus, and a second one in the mid-line on the vaginal wall about 6 cm. back from the first. A mid-line incision is then made through the vaginal mucosa, extending from about 1 cm. from the urethral meatus back for about 5 cm. The vaginal mucosa is dissected laterally.

No attempt is made to dissect digitally lateral to the urethra, as suggested by Aldridge and Studdiford. The author does not believe that this is necessary, and bleeding may be avoided by omitting it. However, the index finger of the left hand is placed at the left side of the urethra. Then, using a long Kelly clamp in the right hand, the space of Retzius is entered from above by penetrating the rectus muscle at the base of the fascial strip. The point of the clamp is directed downward and against the periosteum of the symphysis. By making this precaution the author never has perforated the bladder or had any persistent hemorrhage. In most cases the bleeding is nil. The Kelly clamp is then forced down lateral to the urethra, aiming at the tip of the left finger below. In some instances the fascia at this point is so tough that it is perforated

FIG. 89. Modified Goebell-Frangenheim-Stoeckel operation. The fascia-lata strip is in place. It is being sutured with the proper tension to the fascia and knotted as shown in B and C.



sutured to the rectus fascia. Using a small Kelly clamp, the fascial strip is drawn through the suburethral tunnel. Then a long Kelly clamp is brought down retropubically on the opposite side. The end of the fascial strip is grasped and withdrawn to its suprapubic position, where it is sutured with the proper tension (Fig. 89).

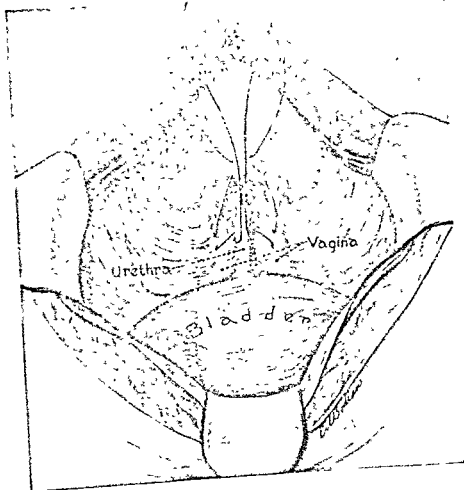
Figure 90 shows the final picture of a urethra which was constructed in a case of epispadias with complete absence of a urethral tube. Although the outer end of the urethra is gaping, the patient was given complete continence by using a sling by the method just described.

#### TECHNIC: SLING OPERATION WITH MERSILENE RIBBON

Using 5-mm. mersilene ribbon, the sling operation becomes a simple procedure. A

transverse incision is made about 2 cm. above the symphysis about 6 cm. in length. The rectus fascia sheath is exposed, and two slits are made in the fascia as shown in Figure 89. The operator then addresses himself to the vaginal field of operation and makes a longitudinal slit through the vaginal mucosa on either side of the urethra. It is thought best to do this rather than make a mid-line incision beneath the urethra. If the mid-line incision is made and the mucosa dissected laterally, there is the possibility of sloughing of the edges of the mucosa. This would expose the mersilene to infection and probably would make it necessary to remove it. The suburethral region is tunneled through between the vaginal mucosa and the urethra, as shown in the inset in Figure 87 A. The operation is completed by bringing the mersilene ribbon retropubically and around

Fig. 91. Marshall-Marchetti operation. (A) Exposure of retro-pubic space, showing introduction of first stitches.



muscles, as indicated in Figure 91 B. The tying of these sutures snugly and the elevation of the vagina can be aided by upward pressure of an assistant's fingers in the vagina. Thus, the space of Retzius is obliterated, and a wide area of the superior surface of the urethra and the vesical neck is opposed to the symphysis and the posterior surfaces of the rectus muscles (Fig. 91 B). Additional sutures are now placed in the musculature of the lower and lateral portions of the bladder. Their long ends are sutured to the posterior surface of the rectus muscles. One small rubber drain is inserted into the wound, and the abdominal wound is closed in the usual manner.

Inspection of the vagina following this procedure reveals that the cystourethrocele no longer exists, the entire vaginal wall together with the urethra being markedly elevated. The Foley catheter is left attached to the thigh by adhesive tape. The catheter is left in the bladder for 7 days.

## RESULTS

The author has had an experience with the sling type of operation over a period of 20 years. Recently, Wharton, Jr., and the author have made a follow-up study of 82 cases done since we first became interested in this type of operation. We found it difficult to compare our results from this type of operation with the results of others with the same procedure and with the Marshall-Marchetti operation. For example, in a recent publication reporting the results of the Marshall-Marchetti operation, Marchetti, Marshall and Shultis report on their personal experiences with 132 patients. The procedure was done on 65 as the first operative attempt. Thus in about only one half of their cases was the operation done after previous surgery for incontinence. All but 19 of our 82 cases had had previous unsuccessful surgery, and in several multiple operations had been done. The cases in which fistulas had been repaired in the sphincter



region leaving much scar tissue constituted a most difficult group. Likewise, those cases in which an entire urethra required construction posed a much more difficult problem than the usual case of stress incontinence. Bearing in mind the operative material, we are able to report, not with complete satisfaction but with some sense of attainment, that 70.7 per cent of our cases were completely cured; 13.4 per cent were improved in variable degrees; and in 15.9 per cent there was no improvement.

#### ANALYSIS OF FAILURES

As much can be learned from our failures as from our successes. Studying our 13 cases

in which the operation was unsuccessful, immediately some facts become apparent. Early in our experience the operation was done on some neurologic bladders, which cases would be excluded today. In one instance, we were dealing with spina bifida in a child with marked neurologic disturbances, among which was complete urinary incontinence. The sling was of no value. There was nothing in the form of normal sphincter action which could be reinforced. When a sling operation is contemplated and a neurologic factor suspected, a cystometric study should be included in the investigation. We have found in a few cases of neurologic bladder, with only partial incontinence and a cysto-

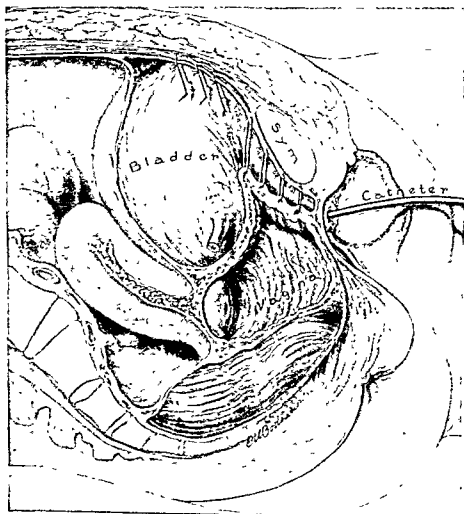


FIG. 91 (Continued). Marshall-Marchetti operation. (B) Off-center sagittal view, showing how sutures have been placed.

metric recording not too much deviated from the normal, that reinforcement of the sling has restored continence.

Another factor contributing to failure is previous surgery and the scar tissue resulting therefrom. Several of the failures fall into this group. This is not to say that an excess of scar tissue should deter one from attempting the sling operation, for we have had many successes in such cases. Nevertheless, it must be recognized that scar tissue resulting from previous surgery does diminish one's chances of success. This again emphasized that the series with the largest percentage of cases in which the operation was done as the primary procedure should have the highest percentage of cures. In one case, the urethra had been completely destroyed by lymphopathia venereum which was inactive, but there was resultant scarring and abnormal tissue with which to work. Also, in another case, there was complete obstetric destruction of the urethra, and a new urethral tube had to be formed by plastic surgery. In this woman, no sphincter was present, and the problem was not the usual one of reinforcement of an existing inadequate sphincter, as in most of the cases in the series.

It is worthy of note that among this group of failures of the sling operation there were 2 cases on which the Marshall-Marchetti

technic was subsequently accomplished successfully. In one case in which a previous Marshall-Marchetti operation had failed, our subsequent sling operation also failed.

It is because of experiences like these that we believe the operator should be familiar with both the sling and Marshall-Marchetti operations, for failure with one procedure does not of necessity exclude another attempt with the other. On certain occasions the operation may even be repeated, since 2 of the 4 repeat sling operations were benefited by a second sling operation even after the initial sling had failed.

The choice between these 2 operations in many cases is not clear in our minds, and perhaps the experience of the operation should be a factor in the decision. There are two conditions in which we would definitely prefer the sling type of operation. The first is the presence of a cystocele and/or a urethrocele. Then we would prefer to correct this condition by anterior colporrhaphy done simultaneously with the sling operation. The second is great excess of scarring about the sphincter region. The opening of the anterior vaginal wall, as is necessary with the sling operation, permits excision of the periurethral scar tissue, which is essential to sphincter action.

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# Vesicovaginal and Urethrovaginal Fistulas

## HISTORY

The subject of vesicovaginal fistula dates from antiquity. Mahfouz of Cairo described a vesicovaginal fistula found in a mummy estimated to be about 4,000 years old. Since the literature contains many historical sketches of the subject, no attempt at such a review will be made here, but reference will be made to a few of the milestones in the development of our present operative knowledge. No one man is responsible for this knowledge; it has been acquired step by step through the tireless efforts of surgeons dating back to the 17th century. Before that time the condition was considered hopeless, and one sees references even as late as the middle of the 18th century to the treatment of these fistulas by the wearing of a pulverized toad in a little bag over the pit of the stomach. The more practical-minded of those times devoted their efforts to making receptacles to catch the urine, thus making the life of the victim more endurable.

The first real surgical contribution was made by a Hollander, H. Van Roonhuyse, whose contributions were far in advance of his time and apparently were overlooked by many later writers who fumbled about with much-less-rational methods. In 1672 Van Roonhuyse recommended:

The placing of the patient in a position appropriate for lithotomy.

The satisfactory exposure of the fistula by a retracting speculum.

The thorough denudation of the margins of the fistula.

The approximation of the denuded edges by means of quills thrust through the edges of the wound and held in place by silk threads.

The dressing of the wound with balsam and absorbent vaginal dressings.

The patient kept quiet in bed until the parts had healed.

There is no report of Van Roonhuyse's successes and failures, but Johannas Fatio, of Basel, reported on 2 cases successfully operated upon by him in 1675 and 1684. He states that he employed the "method of the skilled physician, Van Roonhuyse."

In the early 19th century some workers used caustics to freshen up the edges, and hooks and other devices to draw the edges together, but little real surgical progress was made until 1839, when George Hayward, at the Massachusetts General Hospital, reported some cases in which he described the important technical point of detaching the vagina from the bladder. Then came ether anesthesia, and it probably was used for the first time for this operation by Hayward in 1847. In 1846 Metzer, of Prague, described using an instrument very much like the Sims's speculum. In 1847 John Mettaver, of Virginia, first used twisted metal (lead) sutures. In 1852 Wutzer, of Bonn, reported curing 11 out of 35 patients. He first used suprapubic drainage.

In 1845 Jobert de Lamballe described his incision for relieving tension on the suture line. It consisted of a transverse vaginal incision anterior to the cervix, whereby the bladder could be freed from the cervix. Gustav Simon, who was a pupil of Jobert and appreciated the value of easing the tension on the suture line, attempted to do this by the use of tension sutures instead of incisions.

Marion Sims's first paper on vesicovaginal fistula appeared in 1852, and it is generally conceded that he is the father of surgery for vesicovaginal fistula in America. There is no doubt that he attained greater success than anyone up to his time. It is interesting

to note, however, that his operation was not new. Each step had been used and described before by the surgeons mentioned above and by others. The only innovation which Sims contributed was the use of silver wire. This was, in truth, one of the greatest contributions, and Sims guarded his priority with such jealousy that he devoted most of his anniversary oration before the New York Academy of Medicine, in 1857, to defending it. He declared it to be "the most important contribution as yet made to the surgery of the present century."

In 1893 L. Von Dittel first described the transperitoneal approach, dissecting the bladder from the uterus and the vagina and closing the opening in the bladder from above. The following year Mackenrodt made a contribution to the technic which was of greatest importance. He incised the vagina in the mid-line across the fistula and then, with knife and forceps, split the margins of the fistula so as to separate completely the bladder from the vaginal wall. He then closed the bladder and vaginal incisions separately. This procedure described by Mackenrodt approximates broad raw surfaces for healing and more nearly approaches our modern methods than any technic previously described.

In 1896 Kelly described a method of closing a large bladder defect by freeing the bladder from the cervix "all the way up to the peritoneum, and widely on both sides by blunt dissection. . . . The part of the bladder freed from its attachments behind was now easily drawn forward and accurately applied to the immovable anterior third." In the communication describing this procedure Kelly mentioned preoperative ureteral catheterization in order to avoid injury of the ureters, a procedure which we have found to be invaluable. In 1914 Latzko described a technic suited to cases of vesicovaginal fistula resulting from total hysterectomy. It consists of obliteration of the vaginal vault with approximation of broad areas of denuded tissue. In 1942 he reported upon 31 cases of vesicovaginal fistula treated by this method with cure of 29, improvement in one case and failure in another. Latzko's contribution has been a truly great one, and in recent years its value has been magnified

by the fact that there have appeared so many fistulas resulting from total hysterectomy. Since using his technic for the closure of these postoperative fistulas we have not had a failure.

## ETIOLOGY

Vesicovaginal fistulas (Fig. 92), as seen today, fall into 3 groups: (1) those resulting from obstetric injury; (2) those resulting from operative accidents, chiefly during abdominal panhysterectomy; (3) those resulting from extension of carcinoma of the cervix or the radium treatment of this disease; and (4) a small miscellaneous group. Formerly, those following obstetric injury formed the largest group, but the improvement in obstetric methods has greatly reduced their number. The increased popularity of total hysterectomy has resulted in a great increase in operative fistulas. Recent contributions by Norman Miller and by Holden have noted this fact, and our experience coincides with theirs. In 1956 Everett and Mattingly reviewed the 149 cases of fistula operated upon at the Johns Hopkins Hospital between the years 1933 and 1953. Classified from the standpoint of etiology they are as follows:

Obstetric injury	28 cases
Gynecologic surgery	65 cases
Carcinoma of cervix and its radiation therapy	48 cases
Miscellaneous	8 cases

The 3 principal types mentioned above are so grouped from an etiologic standpoint, but also they fall naturally into the same groups when considered from the point of view of cure. The obstetric fistulas should be repaired by the vaginal route in most instances. Those resulting from total hysterectomy are usually very high in the vagina. They, too, may often be approached best by the vaginal route, but in some instances are best repaired transperitoneally. Those formed by the breaking down of carcinomatous tissue in the vesicovaginal region are usually not repairable. When the fistula is the result of a radium burn or of the destruction of carcinomatous tissue in the vesicovaginal septum by radium or x-rays, the closure is usually very difficult, due to reduced blood supply and excessive scar tissue. Before attempting the cure of such a

fistula, multiple biopsies should be taken from the edges of the fistula and the cervix to establish the fact that all carcinomatous tissue has been destroyed.

### SYMPTOMS AND DIAGNOSIS

The successful treatment of vesicovaginal fistula depends upon an exact diagnosis; it is impossible to discuss treatment without reference to diagnostic signs and procedures. With a small fistula the urinary leakage may be slight and, in some instances, dependent upon the position of the patient. Women with such a fistula may void a good quantity of urine, whereas, with larger fistulas, sufficient urine does not collect in the bladder to permit voiding. With marked incontinence the vulva usually becomes reddened and excoriated, and urinary salts may collect on the parts. Pustules frequently form on the vulva and the thighs. The odor of decomposing urine may be so offensive as to be disgusting to the patient and repulsive to others.

The diagnosis usually lies between vesicovaginal fistula and incontinence due to weakness of the sphincter. When the loss of urine is due to weakness of the sphincter, urine usually can be seen to spurt from the meatus when the patient is asked to cough. When the fistula is large, it is easily palpated through the vagina or seen with the patient in the knee-chest, the Sims lateral or the lithotomy position. If no fistulous opening can be readily demonstrated, often it may be found by filling the bladder with a weak solution of methylene blue solution and then inspecting the anterior vaginal wall. If no point of leakage is discovered by this method, a clean sponge is placed in the vagina, and the patient is allowed to walk about, the sponge being removed later and inspected for stains. The air method of Kelly is admirably adapted for cystoscopic examination of these patients. This always should be done in order to ascertain the size and the position of the fistula and particularly its relation to the ureteral

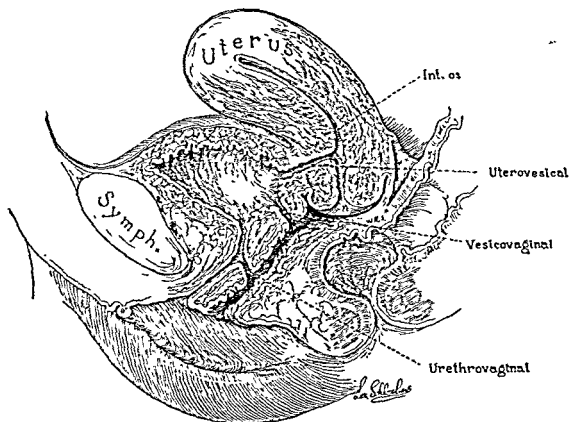


FIG. 92. Diagrammatic sagittal section showing locations of vesicocervical, vesicovaginal and urethrovaginal fistula.

orifices and the vesical sphincter. When the cystoscopic examination is made with a water cystoscope, difficulty is experienced in filling the bladder when the opening is large. With the air method, the bladder expands satisfactorily, even in the presence of a large fistula.

When a urinary fistula develops postoperatively, the diagnosis lies between vesicovaginal and ureterovaginal fistula. Needless to say, an exact differentiation is necessary before considering treatment. If the bladder is distended with methylene blue solution, and the urine in the vagina is unstained, the communication is with the ureter. This should be confirmed by cystoscopy, which will show the ureteral orifice on the affected side failing to spurt urine. Usually a catheter will meet with an obstruction when the tip reaches the point of ureteral injury.

#### TREATMENT: GENERAL PRINCIPLES

Specific examples of the different types of operations as done in our clinic will be described later in detail. Some of the principles

which we believe to be important are enumerated here:

1. It is an advantage to have the tissues in as good condition as possible before attempting the operation. In the case of postoperative or postdelivery fistulas, generally 6 months should elapse from the time of injury before attempting the repair. This important point which Hunner emphasized frequently is disregarded all too often, and attempts at repair are made too early when the condition of the tissues makes success impossible. One always should remember that every unsuccessful attempt at closure produces scar tissue and makes future attempts that much more difficult. Hot sitz baths, warm irrigations with potassium permanganate solution, 1-8,000, and weak vinegar douches are useful procedures for the removal of incrustations from the tissues and getting the tissues in good condition for surgery.

2. The choice of the approach to the operative field is all important. We have come more and more to the conclusion that almost all vesicovaginal fistulas should be closed per

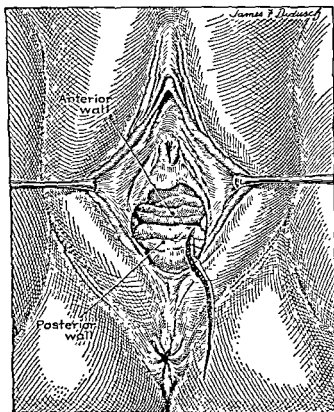
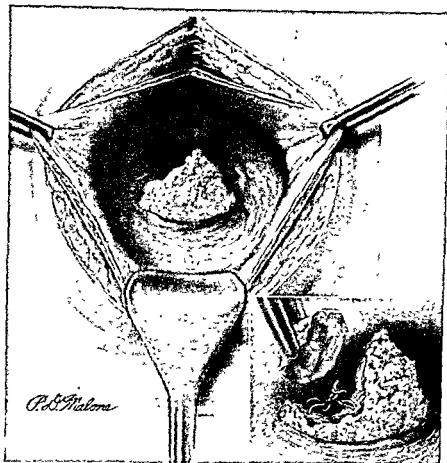


FIG. 93, Schuchardt's incision.

FIG. 94. Demonstrating calculus formation about silver-wire suture, erroneously used in interior of bladder.



vaginam. This is surely true for the fistulas resulting from obstetric injuries. It is equally true for the postirradiation fistulas. Formerly, we attacked transperitoneally many of the postoperative fistulas situated at the apex of the vagina. The adaptation of the Latzko technic to such fistulas has almost done away with the transperitoneal approach. In recent years we have attacked such fistulas transperitoneally only in those rare instances in which many previous vaginal operations have resulted in so much vaginal scarring as to make the fistula inaccessible through the vagina. We do not consider the vaginal outlet a disadvantage to the vaginal approach because an outlet can be enlarged readily by a unilateral or bilateral Schuchardt incision (Fig. 93). We recognize the fact that some excellent surgeons, such as Pfaneuf, recommend the transvesical approach to fistulas and treat them successfully by that method. However, we believe that it is certainly not a method of approach of the usual fistula. We have operated upon an unusual fistula

transvesically, resulting from a spicule of bone perforating the bladder at the time of an automobile accident. The more experience we have with various types of fistulas, the more I have concluded that one should not close one's mind to any avenue of approach and that each case should be considered individually.

When the vaginal approach is used, exposure may best be accomplished at times by putting the patient in the lithotomy position; in others, in the Sims lateral; and in others, in the knee-chest posture. The great majority of our fistulas are repaired in the lithotomy position. Dropping the head of the table and elevating the buttocks often facilitates exposure.

3. Preoperative cystoscopic examination is of great advantage. If the surgeon is skilled in cystoscopy the examination is best done by him so that he can ascertain the relation of the urethral orifices to the fistula. The direct air cystoscope is admirably adapted to this examination, because no matter how large the



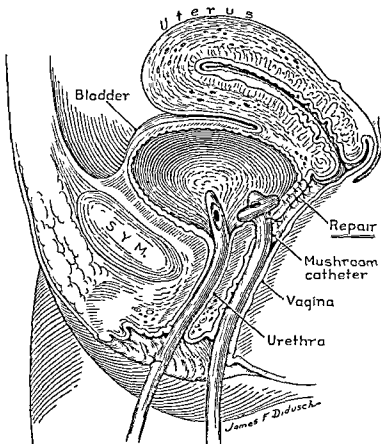


FIG. 95. Demonstrating double bladder drainage through the urethra and the surgical vesicovaginal fistula. The surgical fistula in this case was made just above the trigone.

fistula, the bladder will expand when the patient is in the knee-chest posture. The indirect water method is disadvantageous, due to rapid escape of the water in case the fistula is large. When the fistula is near one or both ureteral orifices either or both of them should be catheterized preoperatively to prevent the inclusion of the orifice or the intravesical portion of the ureter in a suture.

4. A wide area of denudation should be made about the fistulous opening, and the bladder should be sufficiently mobilized to prevent closure without tension. Wide denudation is particularly important in the closure of postirradiation fistulas, because the scar tissue surrounding the fistula is poor in blood supply, and healing is at a great disadvantage. Therefore, it is desirable to approximate as broad surfaces as possible to enhance the chance for healing. Also, the farther one dissects away from the fistulous opening, the better the blood supply becomes.

The first row of fine catgut sutures should

not enter the bladder but should be taken parallel with the edge of the fistulous tract so as to invert the edge into the bladder. If possible, the first row of sutures should be reinforced by a second one. Usually, interrupted sutures are preferable to a continuous suture. Silver-wire sutures which approximate the mucosal edges should pick up the subjacent tissue to obliterate the dead space. Wire sutures never should be buried in the closure and under no circumstances should they enter the bladder. If they do, a calculus will form around them (Fig. 94).

5. Separate closure of the vaginal incision with interrupted sutures of silver wire or fine catgut greatly increases the chance of success. The silver wires may be left in from 14 to 16 days without showing evidence of infection. If the vaginal flaps are sufficiently mobile to permit, it is desirable not to have the bladder and the vaginal suture lines superimposed one on the other.

6. There should be no absolute rule re-

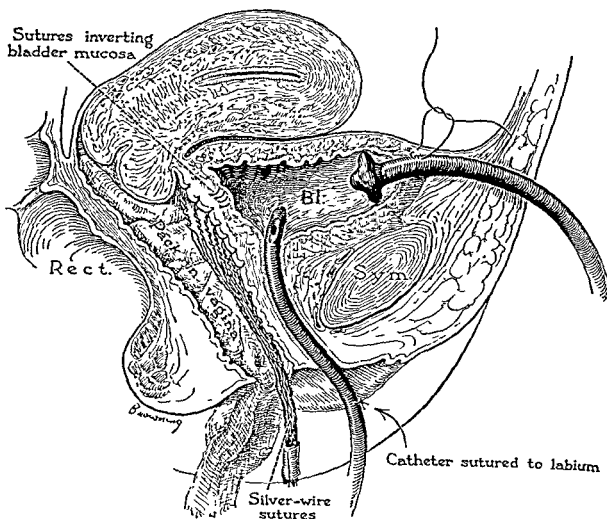


FIG. 96. Double bladder drainage through urethra and suprapubic cystostomy.

garding postoperative drainage of the bladder. In simple cases when the closure has been done with good tissues, and particularly when the operative region has been some distance from the vesical sphincter, a retention catheter may be left in the bladder only over night until the patient is completely alert following the anesthetic. The next morning it may be removed and the patient permitted to get up to void. She should be catheterized immediately for residual urine following voiding. If she empties her bladder down to a residual of 100 cc., further catheterization may be omitted. In slightly more difficult cases an indwelling Foley catheter is left in the urethra. However, in the very difficult cases, especially those in which several previous operations have resulted in failure, double drainage is an excellent plan. Many

a good surgical repair of a fistula has been ruined by a nurse who permitted the bladder to become distended—a consequence of the urethral catheter's becoming obstructed. Establishment of drainage either per vaginam (Fig. 95) or suprapubically (Fig. 96) adds very little to the operation and greatly increases the chances of success. We prefer a therapeutic vesicovaginal fistula to suprapubic drainage. Such a fistula should not be made through scar tissue but if made through normal tissue, the artificial opening will close spontaneously soon after the catheter has been removed. If the anterior vaginal wall does not permit a therapeutic fistula because of the extent of the operative closure or because of scar tissues, suprapubic drainage through a mushroom catheter is quite satisfactory.

7. When the fistula is large and difficult of closure the patient should remain in bed for 14 days. Patients with small fistulas without much scar tissue about them may be up

in a few days without endangering the success of closure. We never have insisted on the patient's remaining in a prone position. If adequate drainage is established so that

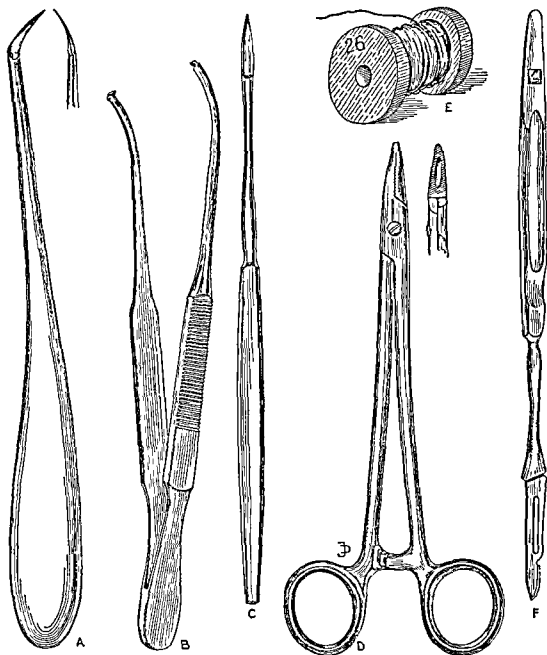


FIG. 97. Useful instruments for repair of vesicovaginal fistulas. (A) Curved, long-handled knife, very serviceable for denuding vaginal mucosa from around fistula, high in the vagina. (B) Long, curved, mouse-tooth forceps, useful for working high in the vagina. (C) Slender, small-bladed, long-handled knife, useful for working deep in vagina. (D) Mayo type needle holder. (E) Number 26 silver wire. (F) Small-bladed, slender Bard-Parker knife, extremely useful in repairing vesicovaginal fistulas.

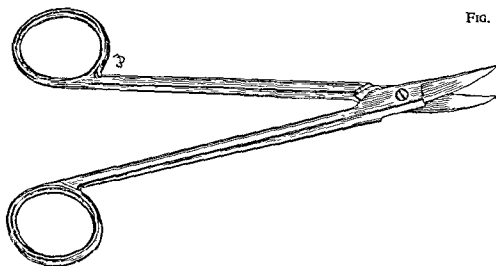


FIG. 98. Curved bladder scissors.

the bladder does not become distended, it makes little difference in what position the patient lies.

8. Only when the closure of a vesicovaginal fistula has been proved to be absolutely impossible should one consider diversion of the urinary stream. In former years we transplanted the ureters into the sigmoid, but experience has taught us that transplantation into functioning bowel usually shortens the patient's life. This is usually due to the development of hydronephrosis and pyelonephritis with the attending disturbances of the chemical constituents of the blood. There are exceptions to this rule but they are rare. We now reserve sigmoidal implantations for cases in which we believe the patient's lifetime is limited by the presence of malignancy. A good example of this would be a fistula resulting from irradiation of advanced cervical cancer when cure is very unlikely. When a fistula is the result of benign disease or injury but impossible of closure, we believe that the implantation of the ureters into an isolated ileal loop is the procedure of choice. We would also prefer this method when an irradiation fistula results from the treatment of cervical cancer when the chances of permanent cure of the malignancy seem good.

9. Special delicate, long, narrow instruments greatly facilitate operative work on fistulas in the vagina. A few examples of these are shown in Figures 97 to 99.

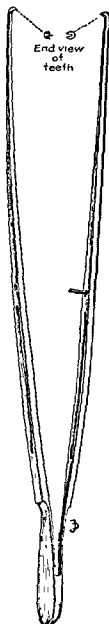


FIG. 99. Long, thin, mouse-tooth forceps admirably suited for vesicovaginal fistula work.

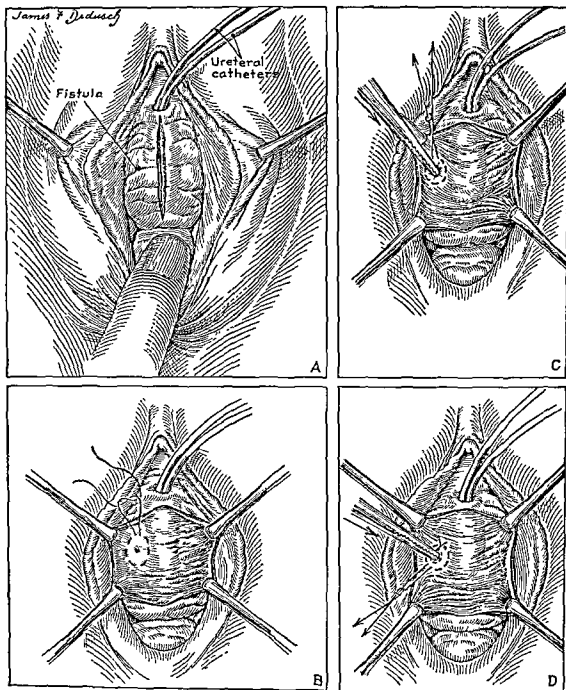


FIG. 100. Closure of a very small vesicovaginal fistula at the trigone. (A) Both ureters have been catheterized for their identification. Since, in this operation, the vesical sphincter was to be plicated also, a mid-line incision is made through the anterior vaginal wall to expose the urethral and trigonal region. (B) A purse string of No. 00 chromic catgut is placed about the opening of the fistula. (C) As the purse string is tied, the tissue is inverted into the bladder. (D) A second purse string is placed around the first.

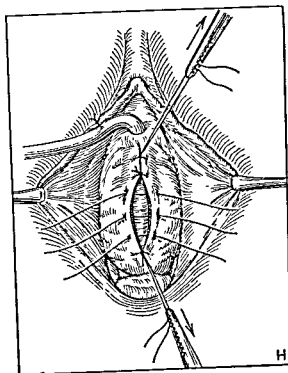
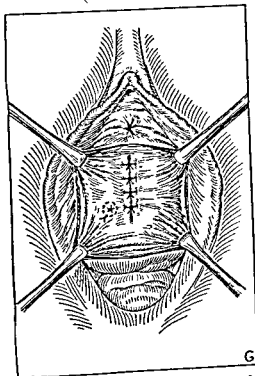
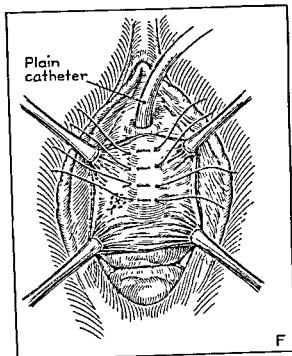
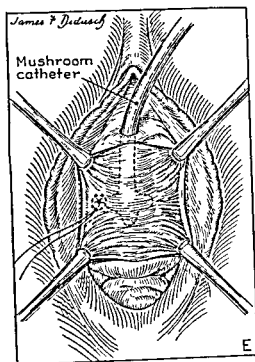


FIG. 100 (Continued). Closure of a very small vesicovaginal fistula at the trigone. (E) Demonstrates mushroom catheter head at the vesical sphincter. (F) Plication stitches have been taken at the vesical sphincter region and along the urethra. (G) The sphincter has been sutured, and the fistula closed. (H) Excess of vaginal mucosa has been excised, and vaginal flaps have been united in the mid-line. The vaginal and vesical closures are not superimposed on each other.

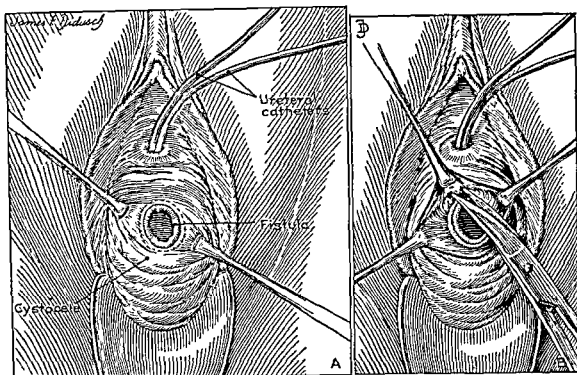


FIG. 101. Standard operation for closure of a simple vesicovaginal fistula. (A) Ureters have been catheterized to prevent encirclement of a ureter with a suture. An incision about the fistulous opening is marked by the dotted line. (B) The vaginal mucosa is dissected back from the fistulous opening for a sufficient distance to mobilize the bladder wall about the fistula.

#### TECHNIC: CLOSURE OF SMALL VESICOVAGINAL FISTULA

Occasionally, a minute vesicovaginal fistula is encountered that may be closed by the simple technic shown in Figure 100. The particular fistula pictured here resulted from too deep fulguration, by a urologist, of an elusive ulcer of the bladder. The patient also had stress incontinence of urine from a relaxed sphincter; therefore, the operation for fistula is combined with plication of the vesical sphincter.

Since the position of the small fistula indicated its proximity to the ureteral orifices, the patient was first put in the knee-chest position, and the ureters were catheterized through a Kelly cystoscope. With the ureteral catheters in the ureters, danger of closure of the ureteral orifice is practically eliminated.

A short mid-line incision is made through the vaginal mucosa from the urethral meatus to the region of the trigone (Fig. 100 A). The vaginal mucosa is dissected free laterally.

A purse-string suture of No. 0 chromic catgut is placed about the fistulous opening (Fig. 100 B).

The fistula is inverted as the purse string is tied (Fig. 100 C).

A second purse string is placed about the first, and the encircled tissue is inverted (Fig. 100 D).

The urethral and vesical sphincter region is then plicated as indicated in Figure 100 E to H. For details of plication technic see page 221.

The mushroom catheter that had been previously placed in the bladder to help localize the sphincter is left in to keep the bladder collapsed for 10 days.

#### TECHNIC: STANDARD OPERATION FOR CLOSURE OF SIMPLE VESICOVAGINAL FISTULA

This simple technic is used in closing an easily exposed fistula in which there is no

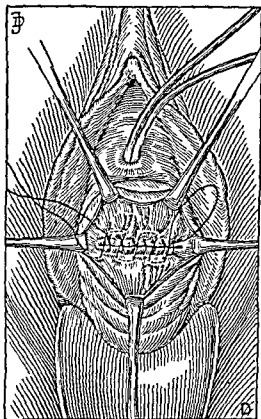
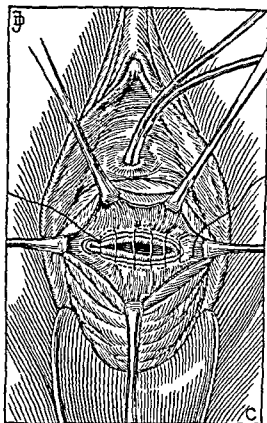
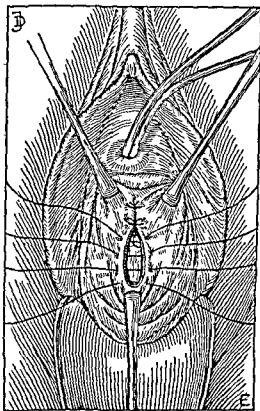


FIG. 101 (Continued) Standard operation for closure of a simple vesicovaginal fistula. (C) The first suture line is placed as a continuous suture of No. 00 chromic catgut, inverting tissue into the bladder. (D) A second suture line is placed, inverting the first. (E) The mucosa has been trimmed and is closed at right angles to the other sutures with interrupted sutures of No. 0 chromic catgut. A mushroom catheter has been placed in the bladder.



excess of scar tissue. It represents a more or less typical closure, if there is such a thing as a typical closure in a condition in which there is such great variation. The simple fistula for which this operation is done is shown in Figure 101 A.

Since the fistula is close to the trigone, the ureters are first catheterized. An incision is made about the fistulous opening, and the vaginal mucosa is dissected free from the bladder for sufficient distance to mobilize



enough bladder wall for a double line of closure. Usually a zone of about 1 cm. is sufficient (Fig. 101 B).

Beginning at one end of the opening, a continuous suture of No. 0 chromic catgut is placed as indicated in Figure 101 C. These stitches are taken parallel with the edges of the opening, well into the bladder wall but not through the mucosa. When this suture is pulled tight, the edges are inverted into the bladder. When complete, it is tied, and a second similar one is placed, inverting the first (Fig. 101 D).

At this stage of the operation the closure is tested by introducing into the bladder about 200 cc. of sterilized milk through a glass catheter. The advantage of milk over methylene blue is that it does not stain the tissues in case leakage occurs. If the suture line is not

watertight, the weak point is further reinforced with interrupted sutures, mobilizing more bladder if necessary.

The vaginal mucosa is trimmed, if redundant, and closed with interrupted sutures of No. 0 chromic catgut. This closure is made in the direction that gives the least amount of tension. In the case illustrated, the vaginal suture line is made at a right angle to the suture line of the bladder wall (Fig. 101 E). It is desirable not to have the suture lines superimposed, the one on the other, but it is not wise to close the mucosa under excessive tension in order to accomplish this.

An indwelling catheter is usually left in the bladder for about 12 days. In simple cases such as this, no secondary bladder drainage is necessary.

Figure 102 demonstrates the closure of a

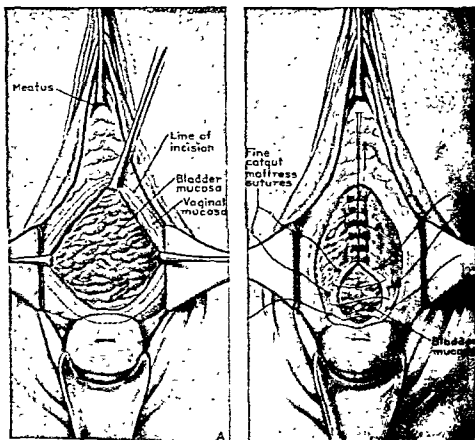


FIG. 102. (A) Large vesicovaginal fistula extending from cervix almost to meatus. (B) First row of mattress sutures have been placed, inverting edge into bladder.

large but simple vesicovaginal fistula, extending from the cervix to the bladder trigone. This fistula was the result of the administration of pituitrin during the second stage of labor. The uterus was ruptured, and the tear extended through the cervix and into the vagina and the bladder. Closure was easily effected after a waiting period of 6 months, when the tissues were in excellent condition.

**TECHNIC: OPERATION FOR LARGE VESICOVAGINAL AND RECTOVAGINAL FISTULAS, FOLLOWING IRRADIATION FOR ADVANCED CARCINOMA OF THE CERVIX**

The fistulas for which this operation was done occurred 12 years after irradiation following total abdominal hysterectomy for carcinoma of the cervix. There was practically a complete loss of the vesicovaginal and rectovaginal septa. Several biopsies, taken from the edges of the fistulas, showed no cancer. The patient was miserable from the leakage of both urine and feces, and the vulva and the thighs were markedly excoriated. Her ultimate condition with a permanent colostomy and voiding urine per rectum was eminently satisfactory to her, in comparison with her original pitiful state.

A permanent colostomy was established by bringing a loop of the sigmoid out through a lower-right rectus incision (Fig. 103 A).

Having diverted the feces from the vulval region, the patient was put on sitz baths, and the condition of the skin of the vulva and the thighs was greatly improved. Then the vagina was completely closed. The insides of the labia majora were denuded, and the labia minora and the clitoris were excised. The raw surfaces acquired in this way were brought together with many interrupted, buried sutures of No. 0 chromic catgut, and the skin was closed with a continuous subcuticular stitch. For 10 days a rectal tube was left in the rectum to drain off the urine while the labia were healing together. After several weeks the upper end of the lower segment of bowel was closed to prevent reflux of urine when the patient reclined. Thus the bladder, the vagina and the rectum were made a reservoir for urine (Fig. 103 B). The patient had complete urinary control and voided per rectum at intervals of 2 to 3 hours.

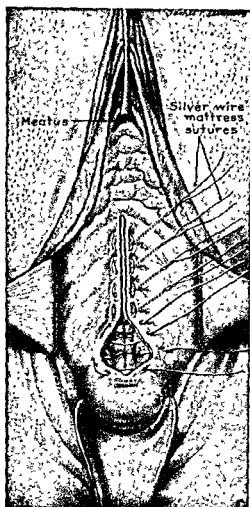


FIG. 102 (Continued). (C) Vaginal mucosa being closed with silver-wire mattress sutures, everting edge into vagina.

**TECHNIC: OPERATION FOR RESTORATION OF URETHRA AND URINARY CONTINENCE**

The following operation is designed for certain cases of urinary incontinence resulting from destruction of the urethra and part of the sphincter from childbirth injury, surgery or from a granulomatous lesion.

A U-shaped flap of vaginal mucosa is dissected free and held forward, thus exposing the undersurface of the trigone and sphincter region of the bladder (Fig. 104 A, B). Rather deep interrupted stitches of medium silk are taken in the sphincter region, which, when tied, tighten the internal orifice (Fig. 104 C).

The flap of mucosa is drawn downward

and an area about 6 to 7 mm. in width is denuded forward on either side for a distance equal to the length of the flap (Fig. 104 D).

The edge of the flap is held forward with

a smooth dissecting forceps and curled under, so that the raw surface of the flap may be sutured to the anterior denuded area (Fig. 104 E). Interrupted sutures of No. 00 chro-

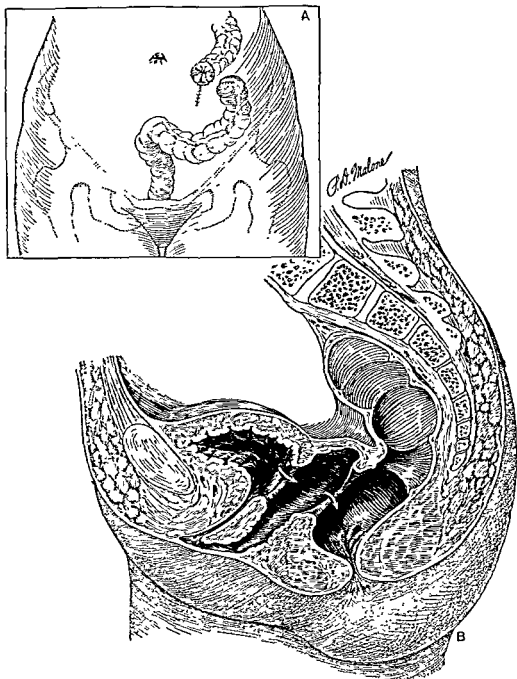


FIG. 103. Method of handling large postirradiation vesicovaginal and rectovaginal fistula. (A) Colostomy, the lower segment of which is closed. It serves as a reservoir for urine. (B) The vagina has been completely closed. The urine accumulates in the bladder, the vagina and the bowel and is expelled per rectum.

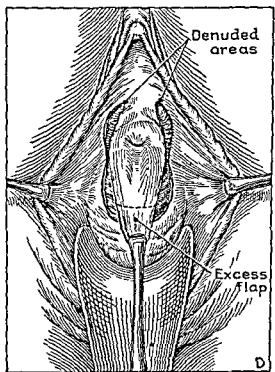
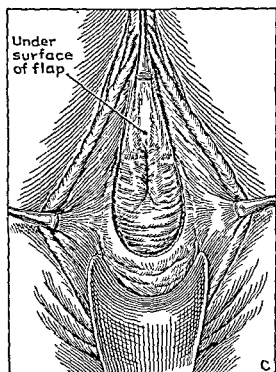
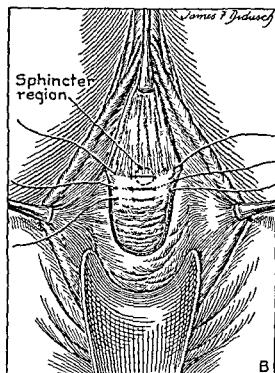
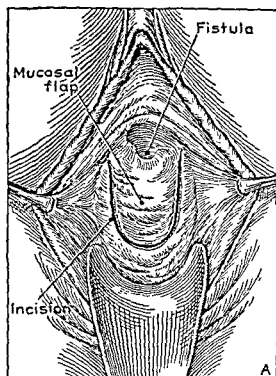


FIG. 104. Plastic operation for formation of urethra and repair of sphincter. (A) A "U"-shaped incision is made through the vaginal mucosa. (B) The mucosal flap has been freed and pulled forward. Three interrupted sutures of medium silk are placed to tighten the sphincter region. (C) The sphincter sutures have been tied, inverting the tissue. (D) The mucosal flap has been pulled downward, and areas have been denuded anteriorly on both sides.

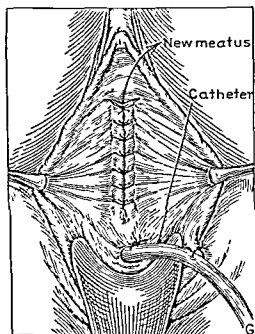
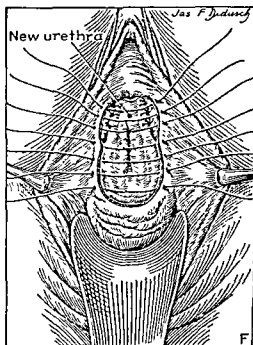
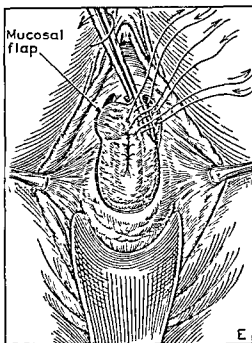


FIG. 104 (Continued). Plastic operation for formation of urethra and repair of sphincter. (E) The flap is sutured anteriorly with No. 00 chromic catgut, rolling the flap inward so as to approximate raw surfaces. (F) Mucosal edges are approximated over the newly formed urethra with interrupted sutures of No. 0 chromic catgut. (G) The bladder is kept empty by means of a catheter in a surgically made vesicovaginal fistula, placed posterior to plastic work.

completely closes the wound (Fig. 104 G).

In order to direct the urine and permit healing of the newly constructed urethra, a surgical vesicovaginal fistula is made at a higher point, and a mushroom catheter is inserted (Fig. 104 G).

#### ANOTHER OPERATION FOR FORMATION OF URETHRA AND RESTORATION OF URINARY CONTINENCE

The operation above described has served well in a few cases of absent urethra, but since the last edition of this book we have performed 2 successful operations by a different method described below. The choice

mic catgut are used. This is repeated on the other side, thus forming an epithelial-lined tube to serve as a urethra.

The wound is closed by approximating the mucosal edges with interrupted sutures of No. 0 chromic catgut (Fig. 104 F). This buries the newly constructed urethra and

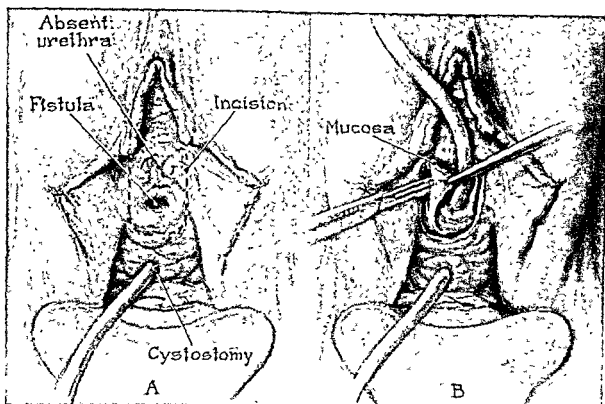


FIG. 105. (A) The U-shaped incision is made as indicated with the dotted line. Urine is diverted through a tube placed in a cystostomy wound. (B) Mucosal flaps are dissected free.

between the 2 operations depends upon where the most well-vascularized vaginal mucosa is available. In the preceding operation there was no redundant mucosa in the urethral region due to scarring, but there was ample well-vascularized vaginal mucosa beneath the base of the bladder. Therefore, a flap was turned forward. In the technic about to be described there was ample mucosa in the urethral region beneath the symphysis. Therefore, it was used to roll up a cylinder to serve as a urethra. After performing this operation successfully on 2 women who had lost their urethras as a result of sloughing after plastic surgery, I have found a description of the identical operation by Falk and Tancer who reported 3 successful cases.

**Technic.** A U-shaped incision is made surrounding the vesical opening and extending forward to the area of the meatus (Fig. 105 A). The bladder urine is diverted through a catheter in the cystostomy wound. Flaps of mucosa are dissected free as shown

in Figure 105 B. The flaps are rolled up to form a tube, being sutured with interrupted No. 00 catgut (Fig. 106 A). This tube is formed around a Foley catheter which has been placed in the bladder. Then the tube is buried by suturing together the pubovesico-cervical fascia with interrupted sutures in the mid-line (Fig. 106 B). In the sphincter region the structures are tightened with as many sutures as are thought necessary in an attempt to give sphincter action. The outer incision edges are then approximated with mattress sutures of No. 26 silver wire, which sutures are tightened to the proper tension by twisting (Fig. 106 C).

#### TECHNIC: OPERATION FOR URETHRO-VESICOVAGINAL FISTULA

The fistula for which this operation was done resulted from obstetric injury which caused a rather large defect in the anterior vaginal wall, the base of the bladder and the first portion of the urethra (Fig. 107 A).

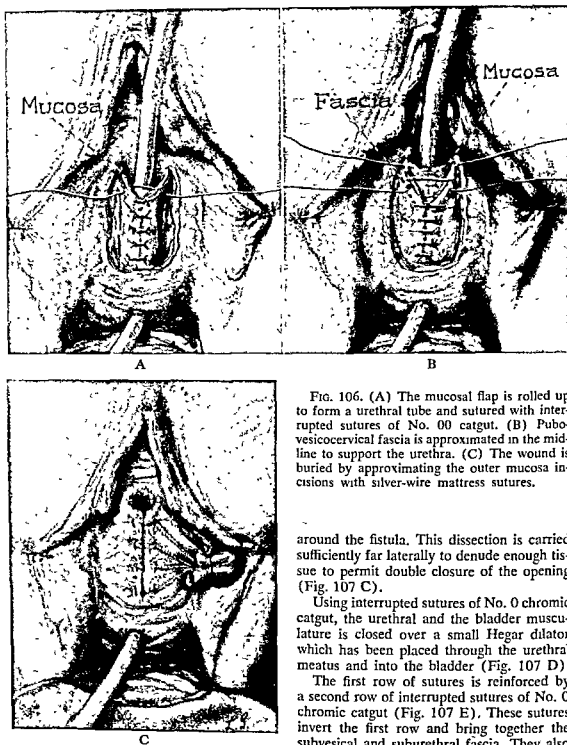


FIG. 106. (A) The mucosal flap is rolled up to form a urethral tube and sutured with interrupted sutures of No. 00 catgut. (B) Pubovesicocervical fascia is approximated in the midline to support the urethra. (C) The wound is buried by approximating the outer mucosa incisions with silver-wire mattress sutures.

around the fistula. This dissection is carried sufficiently far laterally to denude enough tissue to permit double closure of the opening (Fig. 107 C).

Using interrupted sutures of No. 0 chromic catgut, the urethral and the bladder musculature is closed over a small Hegar dilator which has been placed through the urethral meatus and into the bladder (Fig. 107 D).

The first row of sutures is reinforced by a second row of interrupted sutures of No. 0 chromic catgut (Fig. 107 E). These sutures invert the first row and bring together the subvesical and suburethral fascia. They also augment the sphincter action at the internal sphincter region and along the entire urethra.

Finally, the edges of the mucosal wound are trimmed, and the mucosal wound is closed with interrupted sutures of No. 0 chromic catgut (Fig. 107 F).

One of the most important steps in this

The first step in the operation is the insertion of a mushroom catheter through a vaginal cystotomy made above the fistula, to divert the urine from the operative area (Fig. 107 B).

The vaginal mucosa is dissected free from

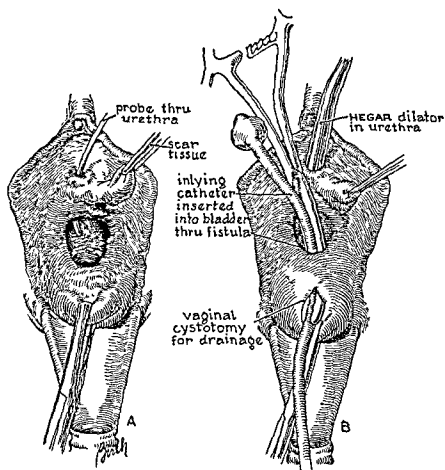
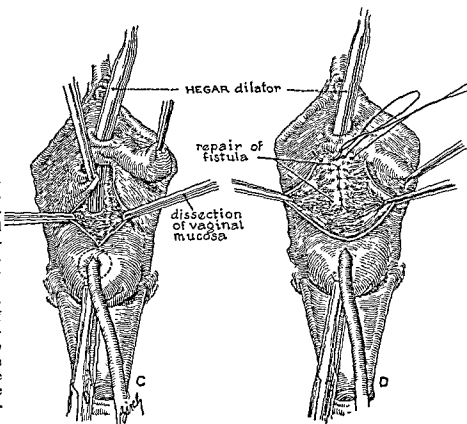


FIG. 107. Repair of vesicourethrovaginal fistula. (A) Indicates defect in vaginal urethral and bladder walls. (B) A vaginal cystotomy is done for drainage above the fistulous opening, and a mushroom catheter is being inserted.

FIG. 107 (Continued). Repair of vesicourethrovaginal fistula. (C) Vaginal mucosa flaps are dissected free laterally. (D) Bladder and urethral walls are approximated with interrupted sutures of No. 00 chromic catgut. These sutures do not pierce the mucosa of the bladder or the urethra but invert the bladder and the urethral edges.





operation is the diversion of the urine from the urethra by means of the mushroom catheter through the cystotomy wound. By means of this, it is unnecessary to use a catheter in the urethra, which would have the undesirable effect of keeping the newly constructed sphincter dilated and also would act as a foreign body in proximity to the sutures.

**TECHNIC: ANOTHER TYPE OF OPERATION FOR REPAIR OF URETHROVESICOVAGINAL FISTULA, INVOLVING SPHINCTER**

This operation was performed successfully to cure a vesicourethrovaginal fistula, resulting from childbirth. A third of the urethra was destroyed and also a portion of the tri-

gone. The sphincter muscles at the vesical orifice were destroyed, and the ends were retracted.

Because the bladder defect was in close proximity to the ureteral orifices, both ureters were first catheterized with No. 7 catheters, using the Kelly air cystoscope. These catheters were left in place until the operation was completed.

The patient was placed on the table in the lithotomy position, and the fistula was exposed as shown in Figure 108 A. A circular incision was made through the bladder mucosa about the edge of the opening, as indicated by the dotted line in Figure 108 A. The vaginal mucosa was dissected free from

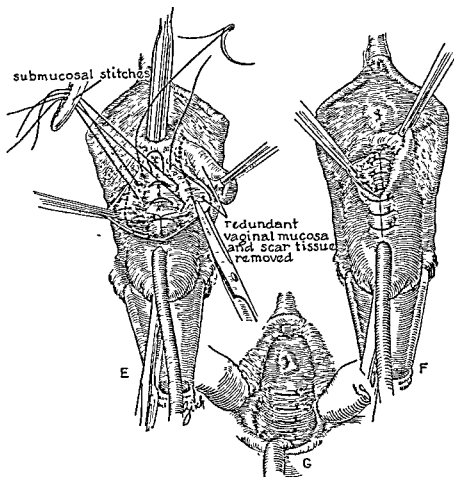


FIG. 107 (Continued). Repair of vesicourethrovaginal fistula. (E) Submucosal stitches approximate the fascia, thus reinforcing the first row of sutures and approximating broad surfaces for healing. (F) After the excess of mucosa is excised the edges of the mucosa are sutured with interrupted sutures of No. 0 chromic catgut. (G) Completed operation.

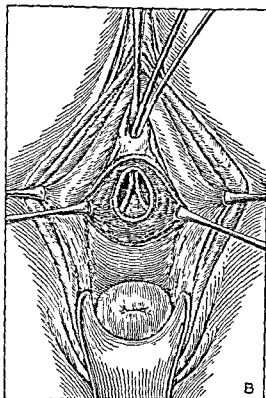
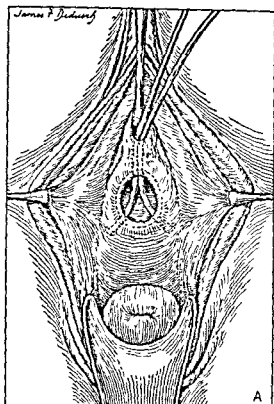
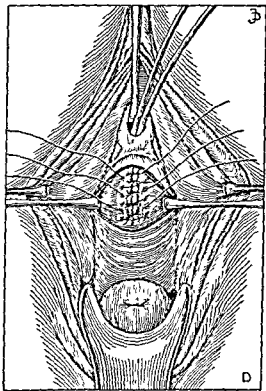
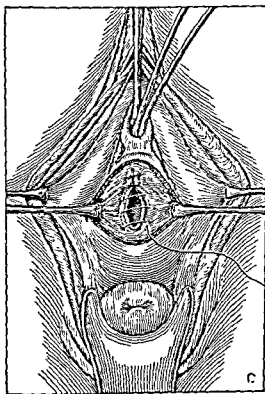


FIG. 108. Repair of vesicourethrovaginal fistula, involving sphincter. (A) Demonstrates fistula. Both ureters have been catheterized. Dotted line indicates incision. (B) The vaginal mucosa has been dissected from around the fistula, exposing the base of the bladder and part of the urethra. (C) The fistula is closed with a continuous Cushing stitch of No. 00 chromic catgut. (D) The first suture line is reinforced with mattress sutures of No. 00 chromic catgut. These stitches further tighten the sphincter by drawing the subvesical fascia together.



the base of the bladder and the vesical end of the urethra (Fig. 108 B).

The defect in the bladder and the urethra was closed from side to side with a continuous Cushing suture of No. 0 chromic catgut (Fig. 108 C). The longitudinal closure was chosen for this fistula in order to approximate the retracted sphincter ends. This suture passed into the bladder musculature but not through the mucosa. When pulled taut, the margins of the fistula were inverted into the bladder. This suture line was reinforced with a second one of interrupted mattress sutures of No. 0 chromic catgut as shown in Figure 108 D. These sutures passed through the subvesical fascia and musculature and thus further approximated the retracted sphincter muscle fibers.

The vaginal mucosa could be closed with least tension transversely (Fig. 108 D). This was most fortunate, for it permitted closure in 2 layers, without necessitating the superimposition of one suture line upon the other. The vaginal mucosa was everted as it was closed with interrupted sutures, using No. 26

silver wire. The wires were twisted until the mucosa was approximated rather loosely. If twisted too tightly, they will cut through the mucosa. The ends of the wires were cut to even length, twisted together and covered with adhesive tape to prevent pricking the patient (Fig. 108 E).

Because the sphincter had been sutured as tightly as possible, it was advisable not to keep the urethra and the sphincter fixed in an open position with a large catheter. Therefore, a No. 12 male rubber catheter was placed in the urethra, and the bladder also was drained suprapubically with a No. 30 mushroom catheter. The importance of double drainage cannot be stressed too strongly in a case such as this. The chances of having a workable sphincter are infinitely better if a cure is effected at the first attempt at repair. If this first attempt should fail and the fistula be cured at a subsequent operation, the scar tissue in the sphincter region would be a great liability in the functioning of the repaired sphincter.

The silver-wire sutures were removed on

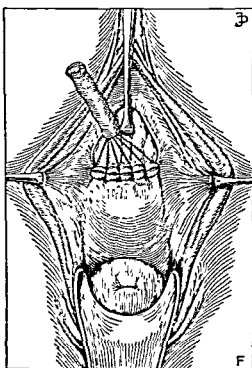
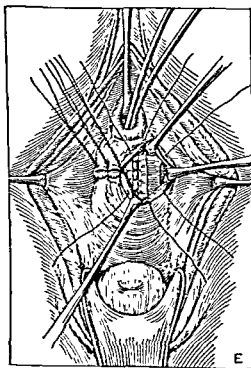


FIG. 108 (Continued). Repair of vesicourethrovaginal fistula, involving the sphincter. (E) The vaginal mucosa is closed transversely, at right angles to subjacent suture line. (F) Fistula closed. The final closure is with No. 26 silver wire. The mucosa is everted as wires are closed by twisting.

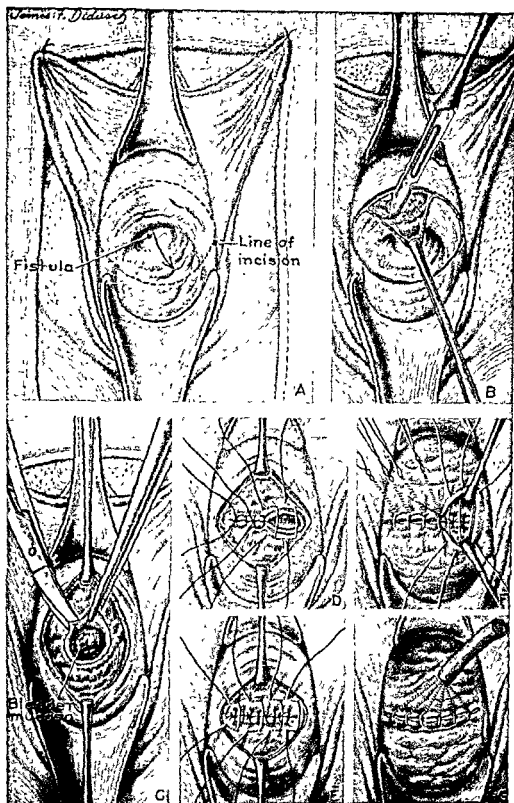


FIG. 109. (A) Line of incision. Mucosa within dotted line is to be removed. (B) Mucosa is being removed by sharp dissection. (C) Vaginal mucosa has been removed. (D) First layer of mattress sutures being placed. (E) Second layer of mattress sutures placed. (F) Vaginal mucosa being closed with silver wire. (G) Completed operation. Ends of wires have been twisted together and covered with rubber tubing.

the 14th postoperative day. Healing was firm, and the patient was obviously cured of the fistula. Hence, the urethral and the suprapubic catheters were removed at that time. Then the patient was permitted up and voided normally; suprapubic drainage ceased in a few days.

#### TECHNIC: LATZKO OPERATION FOR VESICOVAGINAL FISTULA FOLLOWING TOTAL HYSTERECTOMY

This operation is applicable after a total hysterectomy has been done. Since the fistulas resulting from this operation are almost always small and high in the vagina, the shortening of the vagina caused by the approximation of the anterior and the posterior vaginal walls is slight.

Usually the fistula may be brought into operating range by traction sutures. If there is difficulty in accomplishing this the vagina may be made shallower by a lateral episiotomy or a true Schuchardt incision (Fig. 93). At times the incision may also be conveniently drawn downward with a Young prostatic retractor. An oval incision is made for a radius of about 1 cm. about the fistulous opening (Fig. 109 A).

The vaginal and everted vesical mucosa, if present, is cut off as shown in Figure 109 B and C. The denuded areas are brought together with interrupted mattress sutures of double 0 chromic catgut as shown in Figure 109 D. After placing this first line of sutures the bladder is filled with sterile milk and tested for leakage. Even if the first suture line apparently closes the fistula, at least one more similar suture line is placed. If there is any doubt about the blood supply of the approximated tissues a third suture line may be placed. This may require further denudation of the vaginal mucosa. In fact, it is often advisable not to denude at the beginning of the operation as wide an area as may ultimately be necessary. Avoiding early complete denudation often prevents blood loss which may be extremely annoying to the operator and depleting to the patient. After the last catgut suture has been placed the mucosa is closed with silver wire (Fig. 109 F and G). In the average postpanhysterectomy fistula the vagina will not be closed more than 1 or

2 cm. If several previous unsuccessful attempts at closure have been made and much scar tissue surrounds the fistula, considerable vaginal length may have to be sacrificed, but this is a relatively small sacrifice when compared with the incontinence.

#### TECHNIC: UTILIZATION OF LATZKO METHOD FOR CLOSURE OF LARGE POSTIRRADIATION VESICOVAGINAL FISTULA

Although the *sine qua non* for the use of the Latzko technic always has been that the patient's uterus be removed previously, recently we have found an extension of its use in the cure of some large postirradiation fistulas which otherwise would be incurable. In some instances the cervical cancer has been completely cured and the cervix totally eradicated by irradiation, but the patient is left with a large vesicovaginal fistula. The extreme scarring so fixes the tissues that closure of the fistulous opening is out of the question. One should first make certain by biopsy that no carcinoma remains in the region of the cervix or on the margins of the fistula. If the biopsies are negative for cancer, and if at least 3 years have elapsed since the irradiation therapy, it is justifiable to consider relieving the patient of the great distress of incontinence. The fistula is closed by denuding a broad area of both anterior and posterior vaginal walls below the fistula and suturing them together with several layers of interrupted catgut sutures. Including the obliterated cervix in the bladder has proved to be quite innocuous. Although this procedure is applicable in only a small percentage of irradiation fistulas, it has given complete relief to a selected few women.

#### TECHNIC: TRANSABDOMINAL CLOSURE OF VESICOVAGINAL FISTULA

The fistula for which this operation was done resulted from an abdominal total hysterectomy. In most instances, such a fistula can be closed to advantage by the Latzko method. In this instance, however, 6 previous unsuccessful attempts at closure had been made, and excessive scarring so fixed the vagina that exposure from below seemed to be extremely difficult. A urinary calculus had

lodged in the fistula, and a severe cystitis resulted (Fig. 110 A). The stone was first removed.

Through a low mid-line incision the pelvis is inspected with the patient in an exaggerated Trendelenburg position. The intestines are packed back into the abdomen. The bladder is found adherent to the apex of the vagina at the site of the fistula. The peritoneum is cut at its attachment to the vagina and dissected free. It is left attached to the bladder. In making this dissection, it should be borne in mind that the flap of peritoneum is to be used later to bring down between the bladder and the vagina. After freeing the peritoneal flap, the dissection is carried down until the vagina and the bladder in the fistula area are completely separated. Then the vagina is closed with interrupted sutures of No. 0 catgut. The bladder, which has been sufficiently mobilized, is closed with 2 layers of sutures as shown in Figure 110 B. It should be noted that these sutures do not pass through the bladder mucosa and that they invert the edges into the bladder cavity. After thus closing the bladder and the vagina, the peritoneal flap is brought down and sutured to the bladder wall so that the suture line is covered. (See inset in Fig. 110 B).

A drain is placed in the cul-de-sac and out through the lower portion of the mid-line incision. It is considered not to be serious if a vesico-abdominal fistula should develop, since such a fistula usually closes spontaneously. A retention catheter is inserted in the bladder through the urethra and left in place for 12 days.

## URINARY DIVERSION

### CHOICE OF TECHNIC

It is not wise to select one method of urinary diversion to be used under all conditions. Although consideration is given to this subject under the heading of vesicovaginal fistulas, urinary diversion today is used more frequently in radical surgery for cervical cancer. It can be said at the outset that cutaneous ureterostomy is unsatisfactory and should be used only in case of dire emergency when it may unhappily be resorted to as a temporary expedient. Aside from the disadvantage of the collection of urine on the abdomen, it is very difficult to keep the ends of the ureters from constricting. We have also concluded that when the urine is to be diverted for a benign condition, such as a hopeless vesicovaginal fistula, the isolated loop conduit is superior to sigmoid implanta-

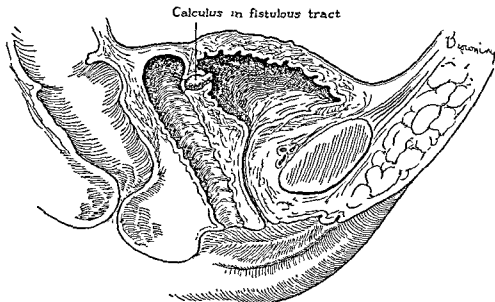


FIG. 110 A. Demonstrating fistula following total abdominal hysterectomy. Six attempts had been made at closure. Calculus apparently had formed about a bit of foreign material left at previous operation.





FIG. 111. (A) Single kidney in woman with incurable vesicovaginal fistula. (B) After complete obstruction of lower end of ureter due to scar tissue following attempts at repair of fistula. (C) Following nephrostomy and 3 weeks after implantation of ureter into ileal loop. Note complete restoration to normal of the kidney pelvis and the calyces.



other cases in which ureterosigmoid anastomoses were causing destruction of kidney function, and reimplantation into an ileal loop resulted in restoration of kidney function (Fig. 112).

In spite of the failure in many cases of sigmoidal implantation, we believe that it does have a place in pelvic surgery. In anterior exenteration operations it becomes obvious in certain cases in the course of the operation that the chances of cure are almost nil. It would be folly to subject such an individual to the extensive operation of the isolated ileal loop. A sigmoidal implantation will often serve the purpose of urinary diversion until the patient dies of cancer. Also, she will have the advantage of continence. There are occasional cases of recurrent cervical cancer with involvement of the urethra and the bladder with urinary incontinence. If the patient is in otherwise generally good con-

dition, we have, on occasion, given temporary relief by implantation into the sigmoid.

Furthermore, occasionally at the operating table a segment of the lower ureter may be removed purposely or accidentally in connec-



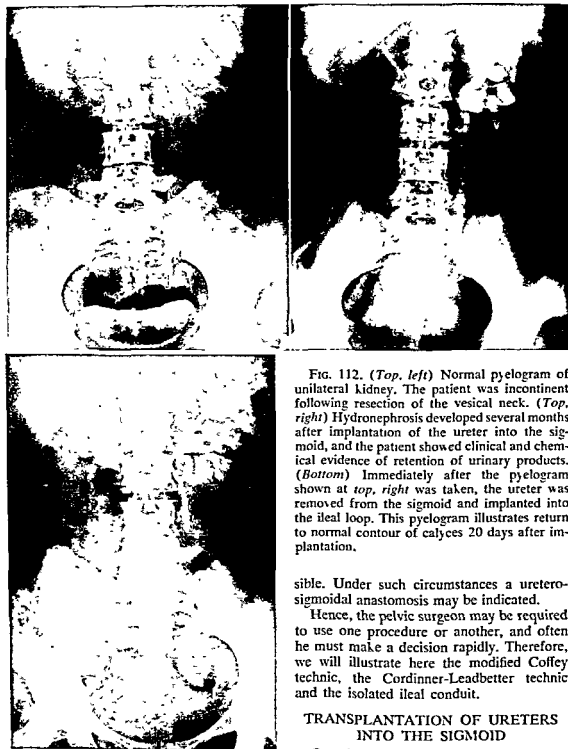


FIG. 112. (*Top, left*) Normal pyelogram of unilateral kidney. The patient was incontinent following resection of the vesical neck. (*Top, right*) Hydronephrosis developed several months after implantation of the ureter into the sigmoid, and the patient showed clinical and chemical evidence of retention of urinary products. (*Bottom*) Immediately after the pyelogram shown at *top, right* was taken, the ureter was removed from the sigmoid and implanted into the ileal loop. This pyelogram illustrates return to normal contour of calyces 20 days after implantation.

sible. Under such circumstances a uretero-sigmoidal anastomosis may be indicated.

Hence, the pelvic surgeon may be required to use one procedure or another, and often he must make a decision rapidly. Therefore, we will illustrate here the modified Coffey technic, the Cordiner-Leadbetter technic and the isolated ileal conduit.

#### TRANSPLANTATION OF URETERS INTO THE SIGMOID

Occasionally, large vesicovaginal fistulas are encountered which defy all attempts at surgical closure. These cases fall into two groups. First, there are the obstetric fistulas in which the base of the bladder and the urethra, including the sphincter region, are

tion with the removal of a malignant ovarian tumor or even a benign ovarian tumor or a huge fibroid. Uretero-ureteral anastomosis or implantation into the bladder may be impos-

destroyed. Although the bladder defect may be closed and a urethra made, the formation of a working sphincter may be impossible. Such reconstructed urethras do not yield well to the artificial sphincter action of the Goebell-Stoeckel procedure. Second, the large fistulas resulting from irradiation of advanced cervical cancer may be impossible to close because of the size of the defect, the inelasticity of the dense scar tissue and inadequacy of the blood supply of the tissue surrounding the fistula.

Fortunately, fistulas of these types are rare, but it is well for the surgeon to have some procedure in his armamentarium to offer these unfortunate women.

Diversion of the urinary stream to the bowel by uretero-intestinal anastomosis is the only possible solution to this difficult problem.

The history of the development of the modern technic for implanting the ureters into the bowel is one of the most fascinating of American surgery. Urologists, gynecologists and general surgeons have contributed to our present-day knowledge of the subject, which has evolved out of much experimental and clinical work. Complications due to soiling the peritoneal cavity have been almost completely overcome due to bowel preparation with antibiotics as described in the chapter on preoperative care. However, hydronephrosis, renal infection and reabsorption of urinary waste products still occur. We have patients upon whom sigmoidal implantations were done as long as 20 years ago who are in apparent good health. Even with these good clinical results the pyelograms are mostly far from normal. Other patients have died within a few years or less of renal insufficiency. In general, we believe that the implantation of the ureters into the bowel, regardless of the technic employed, is apt to shorten the life of the individual.

As early as 1894 Maydl attempted to utilize the valvelike action at the ureterovesical orifices by transplanting, intraperitoneally, the entire vesical trigone with the intact ureters into the bowel. This method has been entirely abandoned, because it is not applicable to most of the conditions for which the implantation is done, such as carcinoma of the bladder and large vesicovaginal fistulas. Maydl's technic was modified and im-

proved by Peters, who performed the same type of operation extraperitoneally for exstrophy of the bladder and thus eliminated the danger of peritonitis.

In 1898 Franklin Martin worked on the problem with experimental animals, with the hope of developing a radical operation for carcinoma of the cervix, excising the bladder with the uterus. He transplanted both ureters through a single opening in the sigmoid or the rectum. He was the first to use rubber catheters in the ureters, and he attempted to create a valve at the ureterosigmoidal anastomosis. It is probable that Martin actually created more of a sphincter than a valve, the distinction being that a sphincter retards emptying of the ureter, whereas a valve permits emptying but prevents back-flow. Martin finally gave up his experimental attempts because the animals all developed renal infection and hydronephrosis.

Thus Coffey was unable to find in the 240 articles in the literature up to 1909 a single instance in which a true uretero-intestinal valve had been constructed. The mortality was high up to this time, approximately 55 per cent. Coffey began his animal and clinical experimental work in 1909, and it extended over 2 decades. In 1911 he reported his first experimental attempts at valve formation by burying the ureter for a short distance in the musculature of the bowel, before inserting it into the lumen. The ureter was drawn *into the bowel through an opening in the mucosa* by means of an anchoring suture, which was made to enter the bowel lumen through the opening and emerged about a centimeter below. This is now known as the Coffey I technic.

Coffey's second method, published in 1925, was also a submucosal transplantation, but he utilized renal catheters in the ureters, which were withdrawn down into the rectum by gauze which had been previously packed in the rectum. This technic has the advantage of permitting drainage of the urine through the catheters until postoperative edema has subsided. Thus both ureters may be transplanted at one operative procedure with relative safety. Coffey's third method, published in 1930, consisted of implantation of the ureter in the submucosa of the bowel with the end of the ureter tied off but not entering

the lumen. A silk or linen transfixion suture was placed through the ureteral wall near its end and into the intestinal lumen. When this ligature sloughed out, a uretero-intestinal fistula was established. Obviously, only one ureter can be transplanted at a time by this method.

In 1933 Higgins modified Coffey's transfixion suture technic and left the ureters intact, connected with the bladder. His transfixion suture penetrated the ureteral wall and the bowel wall, finally being sewed to a rectal tube which is pulled out 4 days later. Following this, the urine passes freely per rectum, and the amount passed into the bladder can be seen to decrease gradually under cystoscopic observation. Nine days after the first operation the bladder is excised for carcinoma, and the lower ends of the ureters are tied off with silk sutures.

The same year Winsbury-White also implanted the intact ureters submucosally. At the second stage of his operation the ureters are divided three fourths of an inch below their egress from the submucosal channel, at which point a longitudinal incision into the bowel is made. The ends of the ureters are inserted into this opening and fixed in place with an anchoring suture.

In 1942 Jewett described a new method of ureteral transplantation in 2 stages for cancer of the bladder. The method consisted of burying the intact ureters in the submucosa of the sigmoid at the first stage. At the second stage an opening is cut through the ureteral and intestinal walls with a specially constructed electrode, inserted through the ureteral stump. For the first few years following the development of this technic Jewett was rather optimistic concerning the results. However, with the passage of time, his optimism has given way to pessimism on the basis of the long-term effect on kidney function.

In 1950 Cordonnier described a method of ureterosigmoid anastomosis by suturing ureteral mucosa to that of the sigmoid. Nesbit refined the technic. Later, Leadbetter, Weyrauch and Young combined the submucosal tunnel principle of Coffey with direct mucosal anastomosis. An analysis of their cases showed that hydronephrosis was less common than after any other type of ureterosigmoid anastomosis and that hyperchloremic

acidosis did not occur in the presence of post-operatively normal upper urinary tract.

Finally, Bricker in 1950 devised a method of using an isolated ileal loop for implantation of the ureters. It has the disadvantage of requiring the patient to use a bag upon the abdomen for the collection of the urine, but it has the great advantage of very nearly eliminating the danger of recurrent pyelonephritis and hyperchloremic acidosis. This advantage is based on the fact that the isolated loop acts simply as a conduit and does not permit reabsorption of urinary waste products and, provided that a good ureterosigmoid anastomosis is done, it does not result in hydronephrosis.

#### TECHNIC: MODIFIED COFFEY II METHOD

Coffey gave his patients castor oil for 2 nights preceding the operation and copious bowel irrigations the night before and early in the morning of operation. The use of sulfasuxadine has done away with the necessity of these procedures. The patient is given 12 Gm. of sulfasuxadine per day in divided doses for 5 days preceding the operation. Early on the morning of operation she is given an ordinary saline enema followed by an instillation of neomycin.

The patient is given a small induction dose of Pentothal Sodium on arrival at the operating room. She is held in the knee-chest posture by 2 assistants, and a sterile sigmoidoscope is passed up the bowel for about 12 inches. A sterile gauze roll is used to pack the sigmoid and the rectum as the sigmoidoscope is withdrawn. Several inches of gauze are permitted to protrude from the anus, and a clamp is placed on it, so that later it may be identified easily between the patient's thighs when the operator desires it to be withdrawn. Recently, we have substituted a sterile rectal tube for the gauze because it is manipulated more easily at the laparotomy. It always should be inserted through the proctoscope in order to be certain that it is passed to the desired length up the sigmoid and not curled up in the rectum.

The patient is placed on the operating table in the Trendelenburg position, and a mid-line incision is made from umbilicus to symphysis. The omentum and the bowel are

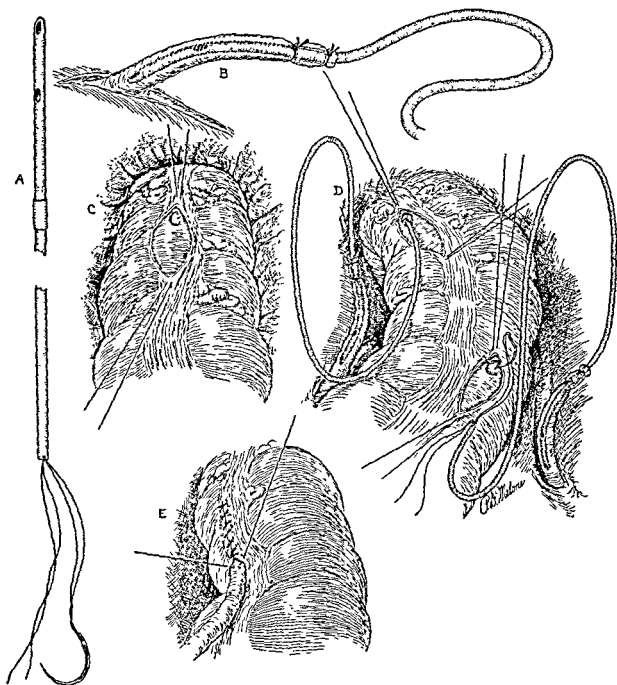


FIG. 113. Implantation of ureter into bowel: Coffey II technic. (A) No. 9 catheter shod with a cuff of small rubber tubing. A silk thread has been attached to end of the catheter, and the needle is left in place for subsequent suture to gauze. (B) The ureter has been cut and freed for a distance from its retroperitoneal bed. The tip end of the catheter has been threaded for a distance up the ureter and tied in place about the rubber cuff. (C) An incision has been made through the longitudinal bowel musculature and a small opening made over gauze into the bowel lumen. (D) The ends of the catheters are sutured to the gauze preparatory to withdrawal of the gauze. Thus, the ureters are pulled into the bowel lumen. (E) The ureter has been buried in the bowel musculature. The final stitch is taken through the ureter to fix it to the bowel. Fine catgut with atraumatic needle is used for the continuous suture. Silk is used for the final fixation suture.

packed carefully into the upper abdominal cavity. Rather deep anesthesia is required to do this satisfactorily. It is our custom to change to ether anesthesia after the patient has been changed from the knee-chest to the Trendelenburg posture. The posterior parietal peritoneum is opened longitudinally over the ureter, beginning at a point just below the pelvic brim, and the ureter is visualized. A tape is placed around the ureter for identification. It is dissected from its bed with blunt dissection, down to a point near its insertion into the bladder, so that as much ureter as possible may be available for implantation into the bowel without tension. Sufficient ureter should be freed to permit easy implantation into the sigmoid, but it should not be dissected free from its bed unnecessarily high so that its blood supply will be disturbed as little as possible. With the ureter freed, it is doubly clamped near the bladder, and the distal end is ligated with No. 1 chromic catgut.

A large catheter with open end is prepared previously with a tightly fitting rubber cuff about 10 cm. from its tip end, and a suture of double medium silk is sewn through the other end of the catheter as shown in Figure 113 A. The prepared catheter is inserted into the upper segment of the ureter until the cuff just enters the end of the ureter. The catheter is fixed firmly in the ureter by tying with No. 1 chromic catgut just above and below the rubber cuff (Fig. 113 B). If a bilateral implantation is to be done, these procedures are repeated on the opposite side.

An incision, approximately 3 cm. long, is then made through the longitudinal muscle fibers of one of the taenia of the sigmoid. Care should be taken that this does not perforate the bowel lumen. If the implantation cannot be made readily at the site of the taenia, the incision is made obliquely through the circular muscular coat. A very small puncture through the bowel mucosa is made at the lower end of the gutter (Fig. 113 C). Thus, the gauze packing or the rectal tube is exposed, and the free end of the catheter is sutured into it (Fig. 113 D). If a bilateral implantation is to be done, this procedure is repeated on the opposite side. An assistant then withdraws the gauze or the rectal tube from the sigmoid under the direction of the

operator. Thus, the lower ends of the ureters are drawn into the lumen of the bowel. The portions of the ureters in which the rubber cuffs lie should be drawn well into the lumen of the bowel to permit them to slough away. The lower ends of the ureters are then buried in the gutter in the bowel wall, with No. 000 chromic catgut on an atraumatic needle. The first and the last stitches pass through the periureteral tissue (Fig. 113 E). This suture line may be reinforced with a second one, using a continuous Lembert suture. The wounds in the posterior parietal peritoneum are closed with a continuous suture of fine catgut. Sulfanilamide powder is sprinkled over the operative regions, and the abdomen is closed without drainage.

The catheters are watched carefully to make certain that they drain freely. If there is stoppage, a few cubic centimeters of sterile saline may be injected to relieve it. This should not be done by a nurse, but only by an experienced house officer who understands the danger of overdistention of the ureter. On about the 10th day gentle traction is made on one of the catheters. If it gives readily, it is removed; if not, traction is made daily until it slips out easily. If a bilateral implantation has been done, 2 or 3 days are permitted to elapse before the second catheter is removed.

#### TECHNIC: CORDONNIER-LEADBETTER URETEROSIGMOID ANASTOMOSIS

This technic of ureteral implantation may be used for implantation into the sigmoid.

The bowel is prepared as described in the chapter on preoperative care. The patient is put in the Trendelenburg position, and the small bowel is packed off. If either ureter is dilated, the dilated one is approached first so that it may be divided and allowed to drain while the opposite side is worked on. This allows for contraction of a dilated ureteral musculature with decrease in circumference and consequent easier transplantation.

The usual procedure is to expose the left ureter through a small incision in the peritoneum below the proximal sigmoid at the pelvic brim. It is divided, and the proximal end of the distal stump is ligated. The proximal ureter is freed from its bed to a point behind the mesentery of the sigmoid through which

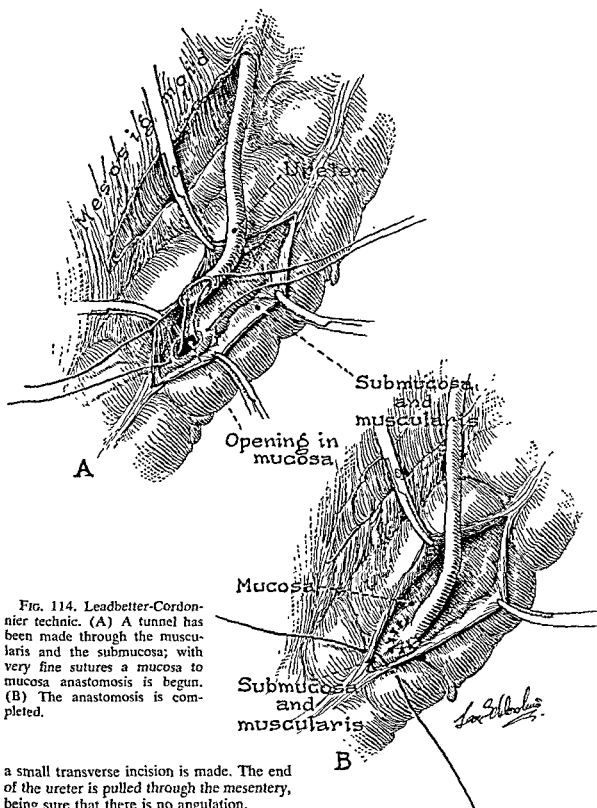


FIG. 114. Leadbetter-Cordonnier technic. (A) A tunnel has been made through the muscularis and the submucosa; with very fine sutures a mucosa to mucosa anastomosis is begun. (B) The anastomosis is completed.

a small transverse incision is made. The end of the ureter is pulled through the mesentery, being sure that there is no angulation.

The site chosen for the anastomosis is at the beginning of the sigmoid as it becomes mobile. The anastomosis is performed through a slightly obliquely placed incision in the anterior taenia. The ureter is care-

fully measured for proper length without tension, and the inferior lip of the cut end is slit for a distance of 5 to 7 mm., trimming the sharp edges of the ureter to leave

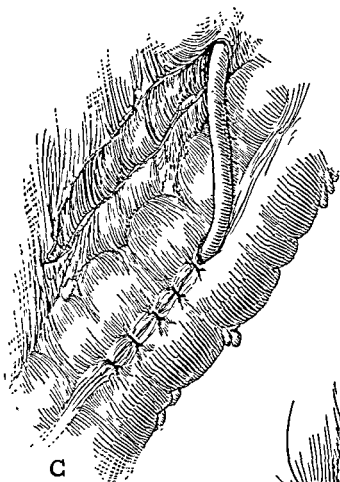
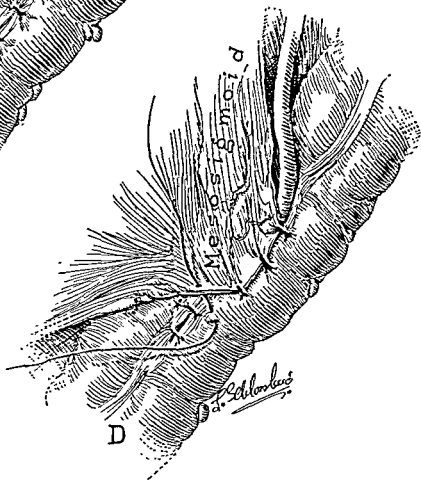


FIG. 114 (Continued). Leadbetter-Cordonnier technic. (C) The muscularis-submucosa tunnel has been closed with interrupted sutures. (D) The mesosigmoid is sutured over the site of anastomosis.



an oval elliptical ureteral os which will be considerably larger than a cross section of the transversely cut ureter.

Then the trough in the bowel is made by incising the anterior taenia for a distance of 2.5 to 3 cm. diagonally toward the point where the ureter will emerge from the retroperitoneum. The incision in the bowel is carried down to the mucosa as shown in Figure 114 A. A small circular opening is made into the mucosa at the distal end of the trough (Fig. 114 B). A direct anastomosis is made between the prepared end of the ureter and the bowel mucosa. Five No. 0

catgut is used to make a watertight anastomosis (Fig. 114 B). The muscular tissues along the trough are loosely sutured together over the ureter as shown in Figure 114 C. Retroperitonealization of the area of anastomosis and fixation of the bowel is accomplished by suturing the superior peritoneal edge of the incision in the mesentery of the sigmoid over the site of the anastomosis. Fine silk is used for this (Fig. 114 D).

The right ureter is implanted with the same technic at the point in the sigmoid where it can be accomplished without tension. Sutures are placed to secure the sigmoid to the pos-

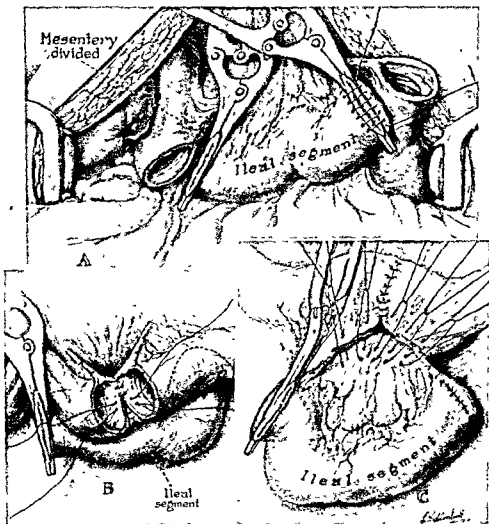


FIG. 115. The intestinal segment is isolated from the terminal ileum about 4 to 6 inches from the ileocecal junction. A segment of 4 to 6 inches is necessary. The rent in the mesentery of the small intestine is carefully repaired. An end-to-end anastomosis is made of the ileum. (From E. Bricker)



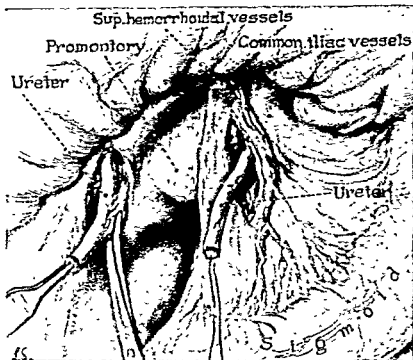


FIG. 115 (Continued). (Left) The ureters are sectioned 2 to 3 cm. below the level of the iliac arteries and freed sufficiently for the implantation, being careful not to strip them of their blood supply.

(Bottom) The side-to-end anastomosis between the ureters and the segment of ileum is completed, mucosa to mucosa, using the finest of catgut and reinforcing the anastomosis with fine silk.

(From E. Bricker)

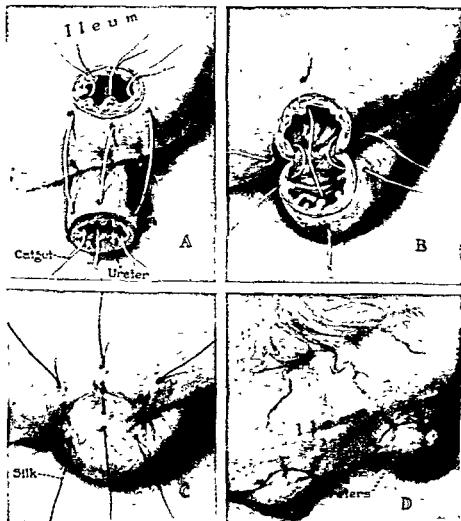
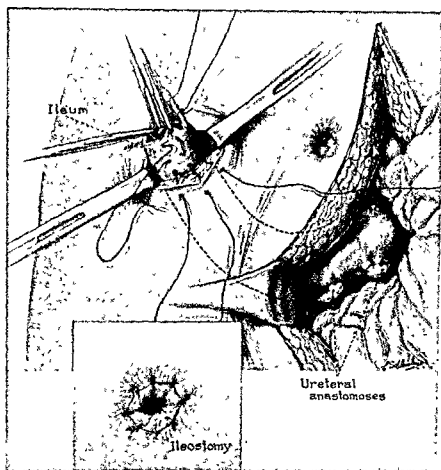


FIG. 115 (Continued). The ileostomy is completed by suturing it to the edge of the skin of a small incision in the right lower quadrant. (From E. Bricker)



terior peritoneum to relieve any tension on the anastomosis.

A long soft-rubber tube with several perforations is placed in the rectum and strapped in place, which is frequently irrigated with saline solution to maintain free drainage. The rectal tube is removed on the 5th postoperative day.

#### TECHNIC: BRICKER'S ILEAL LOOP BLADDER SUBSTITUTION

Bricker has described the technic of the ileal loop bladder substitution operation as follows:

A 6 to 8 inch segment of ileum is isolated with its blood supply carefully preserved. The distal end of this segment is usually located about 6 inches from the ileocecal junction. An end-to-end anastomosis of the remaining ileum is done with two rows of fine interrupted cotton or silk. The proximal end of the isolated segment is closed, the ureters are anastomosed to it, and the distal end is brought out through an accessory incision to the right of the umbilicus.

Great care is used for the uretero-intestinal anastomosis, a meticulous end-to-side, mucosa-to-mucosa, two-layer anastomosis with fine interrupted, nonabsorbable sutures being done. No ureteral catheters or anastomotic splints are used. We no longer close the right lateral gutter since we have decided that the danger of intestinal obstruction from herniation through the large aperture is negligible. On the other hand, we now are careful to tack the left ureter to the under surface of the mesentery in order to reduce the hazard of intestinal obstruction. It is considered of importance to make sure that the bowel segment is decompressed in the early postoperative period. This is accomplished by inserting a catheter into the segment through the abdominal stoma, the mucosa of which is carefully sutured to the edge of the skin incision for primary healing. This catheter is removed on the third or fourth postoperative day, and a Rutzen bag is applied to the stoma. In those few patients for whom bladder substitutes have been made as palliative procedures without pelvic evisceration, a rubber-dam drain has been inserted into the cul-de-sac in case there should

be a leak of urine from one of the anastomoses. In the cases of pelvic evisceration the perineal

drain is considered adequate to take care of this contingency. (Fig. 115)

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# Relaxed Vaginal Outlet, Rectocele and Enterocele

## ANATOMIC CONSIDERATIONS

Before considering the surgical repair of perineal lacerations, rectocele and enterocele, attention should be directed to the anatomy of the vagina and the pelvic floor. The pelvic floor is formed chiefly by the levator ani muscles, aided posteriorly by the coccygeus muscles. The levator muscles form a broad muscular diaphragm which originates in front from the posterior surface of the superior ramus of the pubis lateral to the symphysis; behind, from the inner surface of the spine of the ischium; and between these 2 points, from the obturator fascia. The muscle fibers extend posteromedially, inserting into the sides of the vagina and the rectum and into the mid-line of the perineum, between the vagina and the rectum. Posterior to the rectum, fibers that have passed laterally to the vagina and the rectum insert into a median raphe between the rectum and the coccyx, and finally the most posterior fibers insert into the coccyx.

Superficial to the floor formed by the levators is the urogenital diaphragm (triangular ligament). This is composed of 2 layers of fascia and covers the triangular area between the ischial tuberosities and the symphysis pubis. Lying between the layers of the trigone are the sphincter urethrae and the deep transversus perinei muscles. Superficial to the triangular ligament, and hence superficial to the levator muscles, lie the superficial transversus perinei muscles and the bulbocavernosus muscles. The former muscles arise from the ischial tuberosities and are inserted in the mid-line of the perineum, just posterior to the vagina. The bulbocavernosus muscles arise from the mid-line of the perineum, just

posterior to the vagina, and pass forward along either side of the vagina to be inserted into the clitoris. The vagina, then, forms an opening between the 2 levator muscles and in the urogenital diaphragm. The bulbocavernosus muscles may be considered as the superficial vaginal constrictors; and the levator muscles, the deep constrictors.

All of these muscles are covered with fascia; hence, it is the fascia, not the muscular tissue, that is visible when the dissection is carried out in doing a perineal repair.

The vagina is a musculomembranous tubal structure, reaching from the cervix to the vulva. The orifice has the smallest caliber; above this, the vagina is relatively roomy. The mucous membrane lining is covered with stratified squamous epithelium, which is thin before puberty and after the menopause. During the menstrual life of the woman it is much thicker and is thrown up into rugae. Beneath the epithelium there is fibromuscular tissue, and outside of this the perivaginal portion of the endopelvic fascia. Anteriorly, this fascia extends from the symphysis beneath the bladder and is inserted in the anterior surface of the cervix at about the level of the internal os. This is the pubovesicocervical fascia that is utilized in cystocele repair. Posteriorly, there is also an extension of endopelvic fascia which is less sturdy than the anterior fascia, but it is utilized in rectocele repair.

Posteriorly, the upper part of the vagina lies in proximity to the cul-de-sac of Douglas. In the average normal case this is not more than the upper fourth of the vagina, but in some women the cul-de-sac is congenitally much deeper. Occasionally, this peritoneal

sac may dissect deeply down into the rectovaginal space and form a peritoneal pouch in which intestines lie.

Below the level of the cul-de-sac, the vagina is in close apposition to the anterior rectal wall for about half the length of the vagina. In this mid-portion the vagina is separated from the rectum only by a thin layer of fascia which forms the rectovaginal septum. This middle half of the posterior vaginal wall is most susceptible to rectocele formation. In the lower fourth the vagina and the rectum diverge and ultimately are separated by the perineal body. This body is formed by the union of the levator ani muscles, and superficial to them the union of the deep and the superficial transversus perinei muscles. These structures, covered with fat and skin, constitute the perineal body.

The effect of the descent of the child's head upon these structures is one of stretching and often tearing. Stretching of the vagina thins the fascia in the mid-portion of the vagina. The ischemia caused by prolonged pressure of the child's head in this region also weakens the rectovaginal septum. Subsequent heavy work, straining at stool, future pregnancies and all activities which increase the intra-abdominal pressure eventually may produce herniation of the rectum into the vagina.

When the child's head reaches the outlet, there is stretching of the structures mentioned above which make up the perineal body. In most cases some laceration of the mucosa of the fourchette takes place. In those cases in which the tear continues backward, the posterior portion of the urogenital trigone with the superficial and deep transversus perinei muscles are torn apart. Then the levator muscles which lie in close apposition to each other in the mid-line are separated and, when the tear is complete, it extends through the sphincter ani muscle and even up the rectal wall. Thus, the perineal body may be destroyed completely, or the damaged perineum may consist eventually of only thin and weak connective tissue.

The thinning of the rectovaginal septum in the region of the upper vagina may also be a factor in the development of enterocoele. This is particularly true when there is a congenitally deep cul-de-sac. All activity which

increases intra-abdominal pressure will cause the peritoneal sac to dissect deeper and deeper into the potential space between the rectum and the vagina, where the fascia has already been thinned out and weakened.

## SYMPTOMS OF RELAXED VAGINAL OUTLET AND RECTOCELE

First, it is important to stress the point that relaxed vaginal outlet and rectocele may be entirely asymptomatic and require no treatment. Simple relaxation of the outlet is much more apt to be asymptomatic than rectocele. Often, relaxed outlet is a contributing factor in producing a feeling of lack of support when there is an associated descensus of the uterus. The question of which condition contributes more to the symptoms is rather academic because it is well to correct both conditions when surgery is done. Also, when relaxed outlet, with or without rectocele, exists with asymptomatic cystocele, it is our custom to repair the posterior vagina and the perineum when the cystocele is repaired.

However, the rectocele itself may give rise to very definite symptoms that require relief. With a large rectocele the protruding mass may be annoying, particularly when the woman is walking. The patient may be troubled also by a collection of feces in the rectocele pouch, and pressure may be required on the mass through the vagina in order to effect an evacuation of the bowels. Frequently, hemorrhoids are associated with the relaxed condition and may contribute to the general perineal discomfort. In all such cases the hemorrhoids should be removed when the relaxed outlet and/or the rectocele are repaired.

Not uncommonly a patient attributes lack of satisfactory sex relations to the relaxed condition of the perineum. The complaint may originate from herself or her husband. This may be dependent upon the condition of the vaginal outlet and may be a legitimate reason for perineorrhaphy. However, in our experience the lack of satisfactory sex relations often is not due to the local condition. It is frequently evidence of marital incompatibility and, even more often, the natural result of increasing age of both husband and wife. One always should evalu-

ate the whole marital picture before promising improvement from plastic vaginal surgery.

### REPAIR OF RELAXED VAGINAL OUTLET AND RECTOCELE

As the gynecologist gets older his practice to a great degree grows older with him. Thus, he learns that one of the commonest complaints in women over 50 is dyspareunia. With the withdrawal of estrogen the vaginal mucosa becomes thin and sensitive, and there is contracture of the outlet of varying degree. This accounts for dyspareunia, particularly in nulliparous women and those upon whom perineal repair has been done. The gynecologist is apt to see some of his own repairs of several years before and wish that he had not done them. One should always bear in mind the effect of estrogen withdrawal when planning his repair.

First, it should be made clear that the repair of the relaxed vaginal outlet and the

repair of the rectocele are two distinct operative procedures. They are frequently done together, but perineal repair is often done when rectocele is not present. Rarely, a rectocele may be present and require repair in a woman whose outlet is not relaxed. It should be stressed that in performing perineal surgery one does not see the muscles described above. They are ensheathed in fascia, and it is not wise to dissect the fascia from the muscles because the firmest union is obtained by the healing of fascia to fascia.

One should not attempt plastic surgery on the posterior vagina with a preconceived idea of the exact type of operation that one will do. Only after the posterior flap of vaginal mucosa has been dissected up and the size and the position of the rectocele and the presence or the absence of enterocele has been determined can one make a final decision as to what type of operation is required. A few of our standard procedures are de-

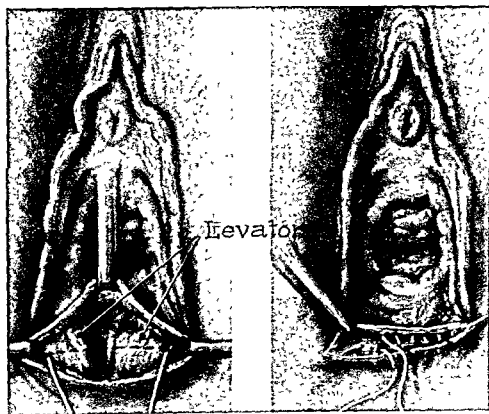


FIG. 116. Most conservative type of repair with minimum narrowing of introitus. (A, left) A single stitch is used to reunite the levators. (B, right) The mucosal flap is sutured to the perineal skin transversely with a subcuticular stitch of fine catgut.

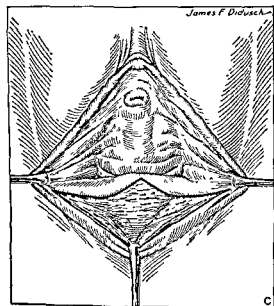
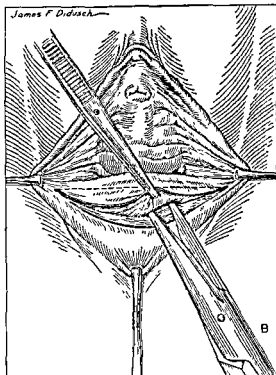
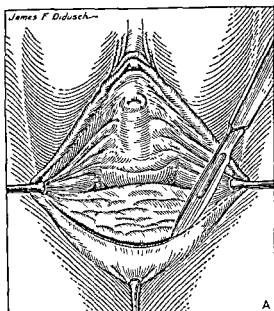


FIG. 117. Simple perineal repair. (A) An incision is made at the mucocutaneous border. (B) The flap of the mucosa is being dissected free. The dotted line indicates the line of excision of the flap. (C) The flap and in addition a small inverted V-shaped piece of mucosa have been excised.

scribed here, but it is understood that variations in technic must be made to fit individual cases.

#### TECHNIC: THE MOST CONSERVATIVE PERINEAL REPAIR

There are some women who have no rectocele and not too much relaxation but have symptoms which may be at least partially attributable to separation of the leva-

tors. One is particularly apt to encounter cases of this type when performing vaginal hysterectomy and/or cystocele repair when the major symptomatology is dependent upon the primary condition for which the operation is done. Support of the perineum can often be adequately provided by bringing the levators together with minimal narrowing of the outlet as shown in Figure 116.

A curved transverse incision is made posteriorly at the mucocutaneous junction, and the fascial sheath of the levators is exposed. A single suture is used to approximate the levators; or, if more narrowing of the outlet is desired, a second suture is used (Fig. 116 A). Without excising any mucosa, the flap is sutured transversely with a subcuticular stitch (Fig. 116 B).

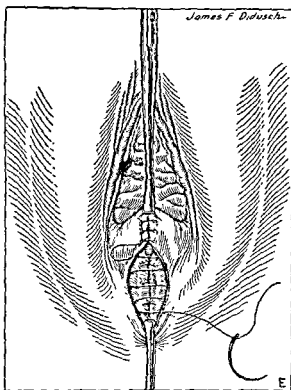
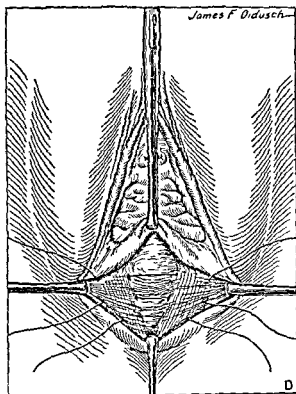


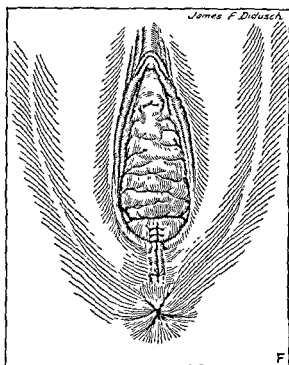
FIG. 117 (Continued). Simple perineal repair. (D) Three interrupted sutures of No. 0 chromic catgut have been placed in the levator ani muscles. (E) The levator muscles have been approximated. The mucosa has been closed with a lock stitch of No. 0 chromic catgut, and perineal skin is being approximated with a subcuticular stitch. (F) Operation completed.

#### TECHNIC: SIMPLE PERINEAL REPAIR FOR RELAXED VAGINAL OUTLET, WITHOUT RECTOCELE

The ultimate size of the vaginal orifice is determined by placing mucosa clips on the labia minora on either side of the outlet and approximating them in the mid-line. These should be adjusted so that the final opening will admit 2 fingers easily. In performing a repair one always should bear in mind postmenopausal shrinkage which ultimately will further contract the orifice to some degree.

A curved transverse incision is then made posteriorly at the mucocutaneous junction, connecting the 2 mucosa clips (Fig. 117 A).

The posterior vaginal wall is dissected upward by blunt and sharp dissection (Fig.



117 B). The operation about to be described is for simple perineal relaxation, without rectocele; hence, the dissection is carried high enough only to expose the fascia covering



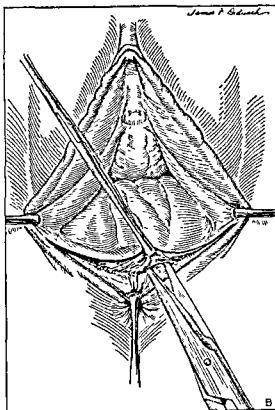
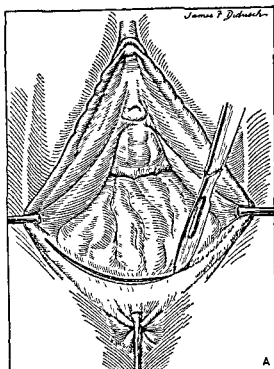
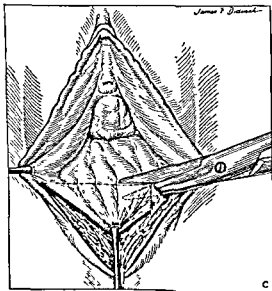
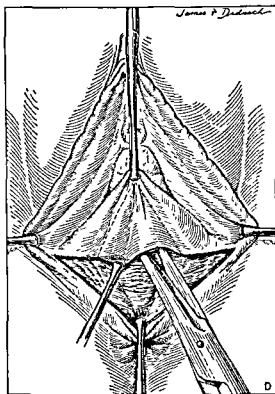


FIG. 118. Repair of medium-sized rectocele. (A) An incision made at the mucocutaneous border. (B) The posterior flap is being dissected free by sharp dissection. (C) The triangular flap of the mucosa is being excised. (D) An inverted V-shaped incision is marked out by a scalpel as indicated by the dotted line. This flap is dissected free and is excised.



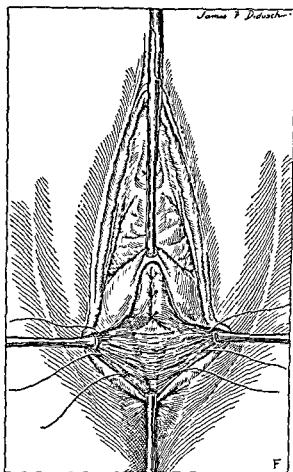
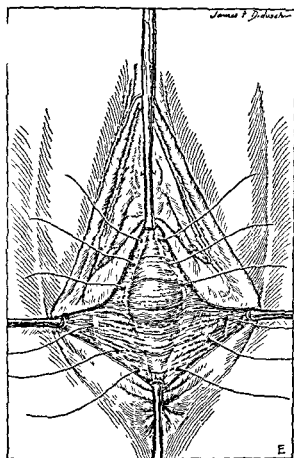


FIG. 118 (Continued). Repair of medium-sized rectocele. (E) Three deep sutures have been placed in the levators. Three mattress sutures have been placed in the perirectal fascia. (F) The fascia sutures have been tied, thus approximating fascia over rectum.

the levator muscles to permit placing of the levator sutures. The flap of mucosa is excised by transverse incision as indicated by the dotted line in Figure 117 B.

Next, a small inverted V-shaped piece of mucosa is excised in the mid-line as in Figure 117 C. This prevents pouting of excessive mucosa in the center of the posterior vaginal wall when the vaginal incision is closed.

Interrupted sutures of No. 0 chromic catgut are taken through the levator muscles (Fig 117 D). No attempt is made to expose the muscle fibers themselves before taking these sutures. The muscles are covered with fascia, and bold stitches are taken laterally to include a liberal amount of the muscle in each bite. The number of stitches taken in

the levator muscles varies, depending upon the degree of relaxation and the tightness of the closure desired. In the average case 3 stitches are taken.

Starting at the top of the inverted-V incision, the vaginal incision is closed in the mid-line, using a continuous lock stitch of No. 0 chromic catgut. When the levator region is reached, the muscles are approximated by tying the previously placed sutures (Fig. 117 E).

This mucosal suture is continued down over the perineum subcuticularly in the mid-line (Fig. 117 E). A small cutting needle is well adapted for this suturing.

Figure 117 F shows the completed operation. In this instance it has been done very conservatively, leaving a rather large outlet.

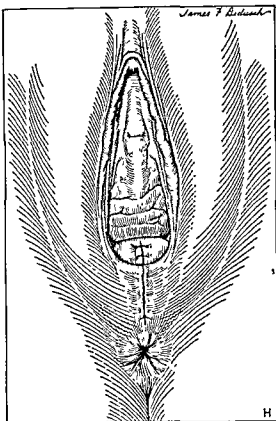
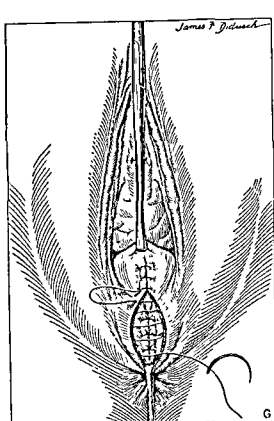


FIG. 118 (*Continued*). Repair of medium-sized rectocele. (G) Levator sutures have been tied, and the mucosa incision closed in the mid-line. This suture is carried down over the perineum subcuticularly. (H) Completed operation.

#### TECHNIC: REPAIR OF RELAXED VAGINAL OUTLET AND MODERATE-SIZED RECTOCELE

The degree of closure of the relaxed outlet is determined by grasping the mucocutaneous border on either side of the outlet with mucosa clips and drawing them together. The final opening should admit 2 fingers easily. An incision is made along the mucocutaneous border, posteriorly, connecting the 2 clamps (Fig. 118 A).

A posterior flap of vaginal mucosa is dissected up by sharp and blunt dissection (Fig. 118 B). When this dissection has been carried up to the level of the clips, the triangular mucosal flap is excised as indicated by the dotted line in Figure 118 C.

A second triangular flap of mucosa is dissected free and excised, with the apex at a point above the summit of the rectocele (Fig. 118 D). Thus, the rectocele and the fascia of the rectovaginal septum are exposed.

Interrupted sutures of No. 0 chromic cat-

gut are taken deeply through the levator muscles (Fig. 118 E). If the dissection is rather bloody, these levator sutures may be placed before excising the mucosal flaps in order to reduce the operating time after the complete dissection and thus conserve blood. Hence, we sometimes place them directly after dissection free of the first triangular flap, before the flap is excised.

The fascia of the rectovaginal septum is then approximated over the rectocele, using as many mattress sutures of No. 0 chromic catgut as are necessary to cover completely the bulging rectal wall (Fig. 118 E). In Figure 118 F these sutures have been tied. In some instances with a small rectocele, the perirectal fascia is approximated with 1 or 2 concentric purse strings instead of these mattress sutures. At this stage of the operation the mucosal closure is started, beginning at the apex of the upper triangle (Fig. 118 G). This is done with a continuous lock suture of No. 0 chromic catgut.

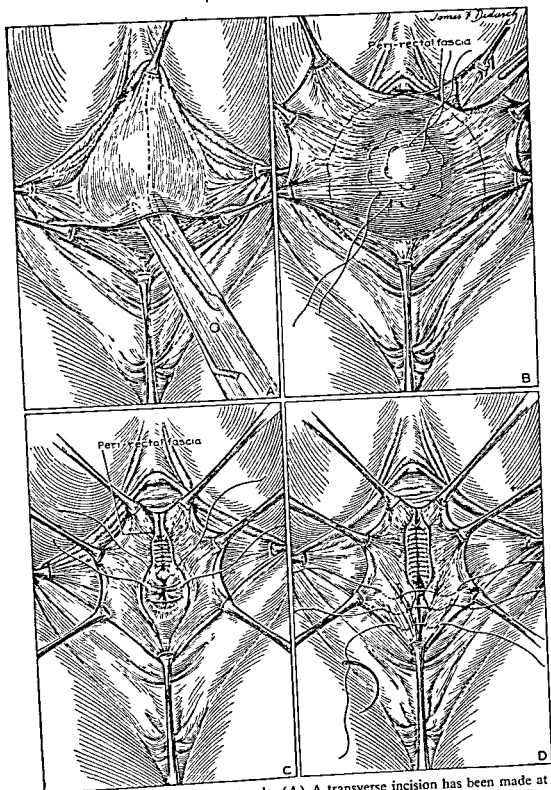


FIG. 119. Repair of large rectocele. (A) A transverse incision has been made at the posterior mucocutaneous border. The mucosa is dissected free in the mid-line by alternately opening and closing Mayo scissors. The mucosal flap is divided as indicated by the dotted line. (B) Two concentric purse strings have been placed. The line of excision of the excessive mucosa is indicated by a dotted line, and the beginning of the fascial dissection with the scalpel is shown. (C) Both purse strings have been tied, and perirectal fascia is being approximated in the mid-line with interrupted mattress sutures. (D) Three interrupted catgut sutures have been placed deeply through the levator muscles.

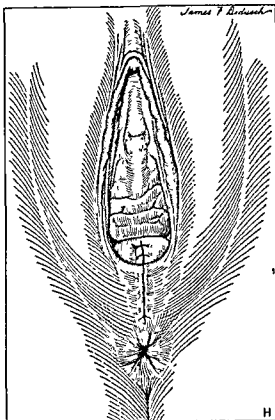
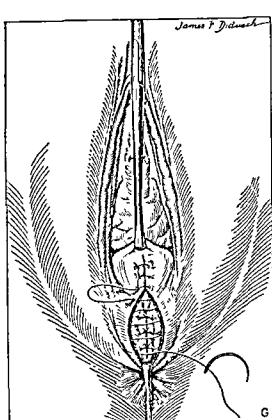


FIG. 118 (*Continued*). Repair of medium-sized rectocele. (G) Levator sutures have been tied, and the mucosa incision closed in the mid-line. This suture is carried down over the perineum subcuticularly. (H) Completed operation.

#### TECHNIC: REPAIR OF RELAXED VAGINAL OUTLET AND MODERATE-SIZED RECTOCELE

The degree of closure of the relaxed outlet is determined by grasping the mucocutaneous border on either side of the outlet with mucosa clips and drawing them together. The final opening should admit 2 fingers easily. An incision is made along the mucocutaneous border, posteriorly, connecting the 2 clamps (Fig. 118 A).

A posterior flap of vaginal mucosa is dissected up by sharp and blunt dissection (Fig. 118 B). When this dissection has been carried up to the level of the clips, the triangular mucosal flap is excised as indicated by the dotted line in Figure 118 C.

A second triangular flap of mucosa is dissected free and excised, with the apex at a point above the summit of the rectocele (Fig. 118 D). Thus, the rectocele and the fascia of the rectovaginal septum are exposed.

Interrupted sutures of No. 0 chromic cat-

gut are taken deeply through the levator muscles (Fig. 118 E). If the dissection is rather bloody, these levator sutures may be placed before excising the mucosal flaps in order to reduce the operating time after the complete dissection and thus conserve blood. Hence, we sometimes place them directly after dissection free of the first triangular flap, before the flap is excised.

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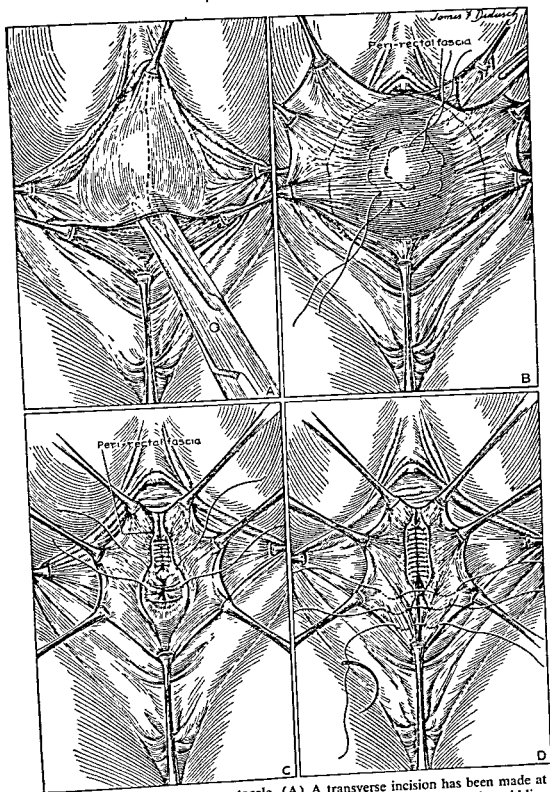


FIG. 119. Repair of large rectocele. (A) A transverse incision has been made at the posterior mucocutaneous border. The mucosa is dissected free in the mid-line by alternately opening and closing Mayo scissors. The mucosal flap is divided as indicated by the dotted line. (B) Two concentric purse strings have been placed. The line of excision of the excessive mucosa is indicated by a dotted line, and the beginning of the fascial dissection with the scalpel is shown. (C) Both purse strings have been tied, and perirectal fascia is being approximated in the mid-line with interrupted mattress sutures. (D) Three interrupted catgut sutures have been placed deeply through the levator muscles.

The levator sutures are tied when the continuous suture approaches the perineal region. Then the continuous suture is continued down over the perineum as a subcuticular stitch, using a small curved cutting needle (Fig. 118 G).

Figure 118 H shows the completed operation.

#### TECHNIC: REPAIR OF LARGE RECTOCELE

An incision is made at the posterior mucocutaneous border, and a more or less triangular piece of mucosa is excised as in an ordinary perineal repair. In Figure 119 A this procedure has already been carried out. The scissors are inserted in the mid-line beneath the mucosa, and by alternately opening and closing the scissors a tunnel is made up to a point well above the apex of the rectocele. This tunnel lies between the perirectal fascia and the rectal wall, which is often covered with some fat. After this tunnel has been completed the mucosa and the fascia are

cut in the mid-line as indicated in Figure 119 A. These 2 layers are dissected from the rectum laterally.

Concentric purse-string sutures of No. 0 chromic catgut are placed in the bulging anterior rectal wall. Very superficial bites are taken in the tissue to avoid perforation of the bowel wall. Sometimes 1 purse-string suture suffices, and again 2 or 3 are necessary to invert the bulging rectal wall (Fig. 119 B). Using the scalpel, the perirectal fascia is freed from the vaginal mucosa (Fig. 119 B). After starting the dissection with the scalpel, often the separation of the fascia from the mucosa can be carried out best with gauze over the gloved finger.

The perirectal fascia is then approximated in the mid-line over the rectum, using interrupted mattress sutures of No. 0 chromic catgut. These mattress sutures are placed from above downward. Figure 119 C shows 4 of such sutures tied, and 2 have been placed below but not tied. The excess of vaginal

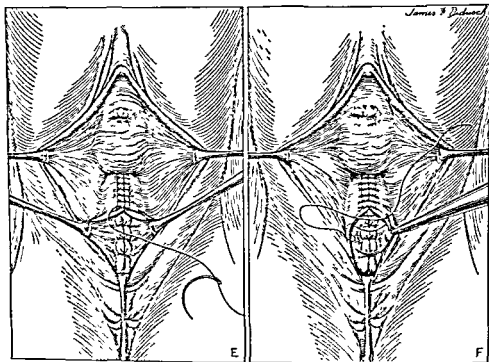


Fig. 119 (Continued). Repair of large rectocele. (E) Levator muscles have been approximated in the mid-line, and the mucosa is being closed with a continuous lock stitch. (F) The mucosal stitch is continued over the perineum subcuticularly.

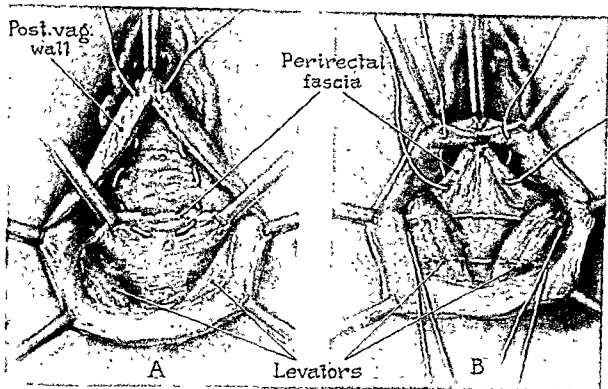
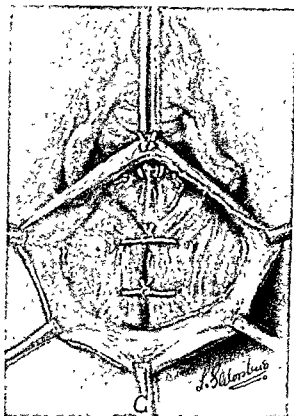


FIG. 120. Repair of high rectocele (A) After dissecting out the rectocele, the well-developed rectovaginal fascia, found lower in the posterior vaginal wall, is elevated with a purse-string suture to fill in the high defect where fascia is practically nil. (B) Purse string has been tied. Lateral defects are closed with an interrupted suture on either side. (C) Levators are brought together in case outlet requires repair.

mucosa is excised as indicated by the dotted line in Figure 119 B.

Figure 119 D shows all 6 sutures tied and the fascia brought together completely over the rectum. Three interrupted sutures of No. 0 chromic catgut are placed in the levator ani muscles (Fig. 119 D).

Before tying the levator sutures, the closure of the vaginal mucosa incision is begun at the apex and carried down with a continuous lock stitch of No. 0 chromic catgut. When the closure is carried down to the point shown in Figure 119 E, the levator sutures are tied. From that point on, the continuous suture is carried down over the perineum subcuticularly as shown in Figure 119 F.



#### TECHNIC: REPAIR OF HIGH RECTOCELE

Failure to obtain a perfect restoration of the posterior vaginal wall is not infrequently



the result of neglecting to recognize weakness in the upper posterior vaginal wall. The operator may excuse himself from carrying his dissection high enough, believing that there is insufficient bulging to justify further dissection. One must remember that the upper portion of the rectovaginal fascia is normally the weakest, and all too often the patient returns years later with bulging high in the posterior vagina. The differentiation between high rectocele and enterocele is discussed in the section on enterocele. Such a differentiation may be difficult or even impossible until the entire posterior wall is dissected up to the cervix.

A useful method of utilizing the stronger lower fascia to reinforce the upper weak area is shown in Figure 120. After the posterior vaginal mucosal flap has been dissected completely free, the lower fascia will be visible with a frayed edge as shown in Figure 120 A. Above this level there may be practically nothing but areolar tissue up to the cervix, separating the rectum from the vagina. The strong lower flap may be brought up and sutured to the posterior surface of the cervix and bilaterally as shown in Figure 120 B. This may shorten the posterior wall somewhat but not sufficiently to be of practical importance. The high rectovaginal fascia may be brought in from the sides and sutured together in the mid-line with interrupted sutures to reinforce this area. The remainder of the repair is done in a routine manner.

## ENTEROCELE

Enterocele or herniation through the cul-de-sac of Douglas is not nearly as common as either rectocele or cystocele, but its recognition is of great surgical importance. The condition is described under various names in the literature: posterior vaginal hernia, rectovaginal hernia, cul-de-sac hernia, Douglas pouch hernia and high rectocele. We object to the term "high rectocele," as this is a definite entity.

Failure to recognize an enterocele when it occurs along with rectocele means failure in attaining a satisfactory surgical result. Like most hernias, probably there is often a congenital factor in its formation, for enterocele has been described in nulliparous women.

A congenitally deep cul-de-sac may serve as the entering wedge by which the hernia sac dissects downward in the space between the posterior vaginal wall and the anterior surface of the rectum. The most important acquired factor in promoting the formation of an enterocele is prolapse of the uterus, and, of course, childbirth is the greatest etiologic factor in prolapse. Frequently, the two conditions are combined. The descent of the uterus is apt to result in an elongation of the cul-de-sac, and the intra-abdominal pressure then carries the dissection downward. Herniation of the intestines through the uppermost part of the vagina occasionally occurs following a vaginal hysterectomy. Such a hernia may merely be the reappearance of a pre-existing enterocele which was unrecognized and hence not properly treated when the uterus was removed. On the other hand, the hernia can make its appearance through a weak point resulting from the operation. Probably the sloughing, which of necessity takes place at the distal ends of the ligaments that have been tied en masse, is responsible for lack of solid support of the newly formed upper pelvic floor.

The patient may complain of a mass protruding from the vaginal outlet on straining or standing. It usually disappears when the patient lies down. The contents of the sac are usually intestine, omentum and/or fluid. We never have observed strangulation of the intestine in these hernia sacs. The large size of the neck of the sac permits the contents to slip in and out easily. In many instances there is a history of previous operations, such as uterine suspension and perineal repair.

Recognition is the first essential factor in the cure of an enterocele. It is unfortunate that the term "high rectocele" has been applied to this condition. In the first place, it is not a rectocele; the contents of the sac are small bowel, not rectum. Secondly, this misnomer has induced surgeons to attempt a cure by performing a rectocele operation at an unusually high level. Often an enterocele and a rectocele occur in the same patient, although either may occur independently. When enterocele is present, without rectocele, its bulging mass may be seen protruding from a high point downward over the lower pos-

terior vaginal wall. When rectocele and enterocele are both present, the diagnosis frequently can be made by inspection, as the division between the two is indicated more or less distinctly by a transverse furrow just above the rectocele (Fig. 121). A finger inserted into the rectum will demonstrate the rectocele as distinct from the bulging at a higher point that is caused by the enterocele.

Having recognized the enterocele, the same principles of cure apply to it as to the cure of other types of hernia: isolation of the sac, disposition of the sac and closure of the defect through which the sac leaves the abdomen. The technic of cure of an enterocele depends to a large extent upon the other conditions with which it is associated. When it is encountered while performing a pelvic laparotomy, the sac may be closed by a succession of concentric purse strings, starting at the bottom of the sac. This procedure, which was described by Moschowitz for cure

of rectal prolapse, is shown in Figure 122. When the enterocele occurs as a herniation through the vaginal vault after a total vaginal hysterectomy, the sac is dissected out from below and excised; all the available ligaments are brought together and sutured to the vagina to give it support and also to secure closure of the hernial defect.

The operation to cure enterocele is often part of an extensive plastic procedure done for co-existing relaxed vaginal outlet, rectocele, cystocele and uterine descensus of varying degrees. When vaginal total hysterectomy is done, the enterocele sac is dissected free and excised, and the neck is closed. The uterosacral ligaments are then approximated for the purpose of strengthening the floor of the cul-de-sac. A similar procedure can be carried out when the operation is combined with the interposition operation. The appropriate time to do this may be when it is encountered on dissecting the posterior flap

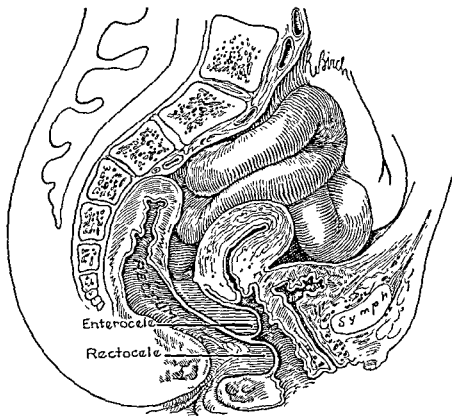


FIG. 121. Sagittal section, demonstrating relative position of rectocele and enterocele.

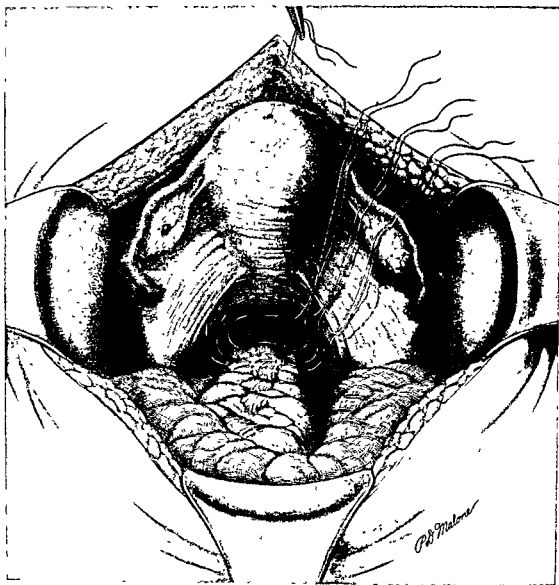
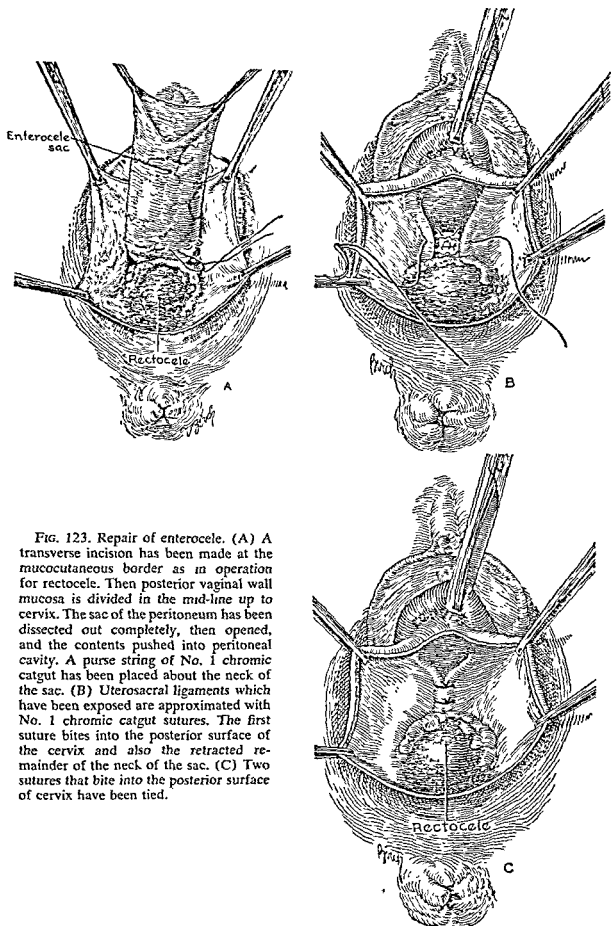


FIG. 122. Method of obliteration of deep cul-de-sac or enterocoele, using multiple concentric purse strings.

of mucosa free from the cervix, before amputation. In most cases, however, it is best repaired when the rectocele is repaired. These procedures can be carried out equally well in connection with the Spalding-Richardson composite operation. Hundley has devised another method for curing enterocoele in connection with the Watkins transposition operation. He obliterates the sac by suturing it to the posterior surface of the uterus.

#### TECHNIC: REPAIR OF ENTEROCOELE

An incision is made posteriorly, at the mucocutaneous border of the vaginal outlet between lateral mucosa clips as in a posterior colporrhaphy. Inserting the curved scissors beneath the vaginal mucosa in the mid-line, a tunnel is made by successively opening and closing the scissors. After tunneling as far as the scissors will reach conveniently, the mucosa is cut in the mid-line. Then the proc-



**FIG. 123.** Repair of enterocele. (A) A transverse incision has been made at the mucocutaneous border as in operation for rectocele. Then posterior vaginal wall mucosa is divided in the mid-line up to cervix. The sac of the peritoneum has been dissected out completely, then opened, and the contents pushed into peritoneal cavity. A purse string of No. 1 chromic catgut has been placed about the neck of the sac. (B) Uterosacral ligaments which have been exposed are approximated with No. 1 chromic catgut sutures. The first suture bites into the posterior surface of the cervix and also the retracted remainder of the neck of the sac. (C) Two sutures that bite into the posterior surface of cervix have been tied.

ess of tunneling and cutting is repeated until the cervix is reached. The vaginal mucosa is dissected laterally on either side, thus first exposing the rectocele, if present, and then the enterocele. The latter appears as a peritoneal pouch, much like a hernial sac, which it is in reality.

Then the sac is dissected free by blunt dissection as high as possible and then opened (Fig. 123 A). After making certain that the sac is free of intestines, a purse string of No. 1 chromic catgut is placed about the neck of the sac (Fig. 123 A). The purse string is tied, and the sac is trimmed off a little distal to the suture.

As the cervix is drawn forward the under-surfaces of the uterosacral ligaments are visible. These ligaments are approximated in the mid-line with interrupted sutures of No. 1 chromic catgut, 2 or 3 of which are required. These sutures should bite into the posterior surface of the cervix and the sac (Fig. 123 B). As they are tied, a firm new base is formed for the cul-de-sac. Figure 123 C shows the enterocele completely repaired. An appropriate operation is done for the cure of the rectocele, if present, and for repair of the relaxed vaginal outlet.

Another method of closing a large sac is to open it and close it from within the peritoneal cavity with a purse string, much in the manner of obliterating the cul-de-sac at laparotomy. Such a suture bites successively into the posterior surface of the cervix, a uterosacral ligament, the anterior rectal serosal surface and finally the opposite uterosacral ligament. After tying this suture, the excessive peritoneum is excised. Then the stump of the sac may be sutured to the posterior surface of the cervix.

#### TECHNIC: REPAIR OF ENTEROCELE FROM WITHIN ABDOMEN (MOSCHOWITZ)

A deep cul-de-sac, a potential enterocele, may be obliterated or a well-developed enterocele may be cured by the Moschowitz operation which was originally devised by him for cure of rectal prolapse.

The patient is placed in the Trendelenburg position, and the intestines are held back in the abdominal cavity by gauze. The uterus is held up and forward with a traction suture

(Fig. 122). Beginning at the base of the sac, a purse string is taken, using medium silk or linen. This is tied, and a second is taken just above it. These sutures are placed with a small round needle, just picking up the peritoneum and biting very lightly into the musculature of the rectum. Successive purse strings are taken, and when the region of the uterosacral ligaments is reached good firm bites are taken through the ligaments and into the posterior surface of the cervix. At the level of the uterosacral ligaments and above, care should be taken to avoid including the ureters in the sutures. The ureters may be catheterized before the operation so that they can be identified easily by palpation, but this is not necessary if one is careful to include only the peritoneum in each bite when in the ureteral region. The number of concentric purse-string sutures depends upon the depth of the cul-de-sac, but it should be sufficient to obliterate at least the space below the level of the uterosacral ligament. Figure 122 shows the purse strings in place, but they have not been tied when placed, as is our usual custom; this technic has been altered here so that the method of placing them may be demonstrated.

#### PREVENTION AND REPAIR OF ENTEROCELE IN CONNECTION WITH VAGINAL HYSTERECTOMY

Since more and more vaginal hysterectomies are being done, it becomes important to consider enterocele repair in connection with vaginal hysterectomy. The subject should be considered from 4 different viewpoints, depending upon the anatomic condition present at the time of the hysterectomy.

1. The prevention of a future enterocele when the anatomy of the cul-de-sac is quite normal.

2. The prevention of a future enterocele when there is a deep cul-de-sac which could develop into a full-fledged enterocele.

3. The cure of an enterocele, not associated with an appreciable rectocele.

4. The cure of an enterocele associated with a well-developed rectocele.

Many enteroceles following vaginal hysterectomy are the result of improper occlusion of the space at the top of the vagina.

This space is obliterated by picking up the stumps of the ligaments which have already been sutured at either angle of the vagina. The suture then picks up the inner surface of the posterior vaginal flap. When tied, the space at the apex of the vagina is completely obliterated.

When there is a deep cul-de-sac the excess of peritoneum can be picked up with the above stitch, and the stitch can be repeated 2 or 3 times until all of the redundant cul-de-sac serosa is puckered into one mass.

When an actual enterocele sac is present without a rectocele, it is not necessary to dissect free the entire posterior vaginal wall as shown in Figure 123. The sac may be dissected free through the incision existing from the vaginal hysterectomy and ligated at its neck. Then the stump of the sac is gathered in with the suture above described,

thus obliterating the space. If there is redundant vaginal mucosa in this area a V-shaped piece may be excised.

When there is also a relaxed outlet and a rectocele requiring repair, it is best to open up the entire posterior vaginal wall and repair the enterocele as above described. After this the rectocele and the relaxed outlet are repaired as indicated.

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# Complete Perineal Lacerations and Rectovaginal Fistulas

## COMPLETE PERINEAL LACERATIONS

### GENERAL CONSIDERATIONS

Laceration of the perineum involving the rectal sphincter and the rectovaginal septum is one of the more serious obstetric complications (Fig. 124). A surprising number of

such cases may be repaired successfully at the time of delivery. Still a fairly large group confronts the gynecologist later, thus making the surgical problem of repairing them of major importance. Although nearly all of these injuries are the result of delivery, some rare cases may be attributed to operations for rectal fistulas or hemorrhoids, and, occasionally, a complete perineal laceration may result from falling astride some sharp object.

In 1929 when Smith and Linton reviewed the cases of complete perineal laceration treated at the Woman's Free Hospital, they found no decrease in the number of complete lacerations that had been seen yearly since the founding of the hospital in 1875. However, it is our impression that there has been a definite decrease in the number of cases of complete laceration in our clinic in the past decade. We are inclined to attribute this to better prenatal evaluation of the obstetric problem, the more careful use of the forceps and especially to the more frequent use of episiotomy.

The classic symptoms of loss of control of feces and gas are present in the majority of the cases, but since there is a great variation in the "completeness" of "complete" perineal lacerations, there is also considerable variation in the degree of incontinence. In some instances a few sphincter fibers are left intact with satisfactory control except with loose stools; in others the band of scar tissue that bridges the gap between the sphincter ends gives sufficient sphincter action to permit control of feces when the stool is of normal consistency and moderately good control of flatus, while in some cases the tear extends well up the rectum so that feces and gas escape at all times (Fig. 125). Not un-

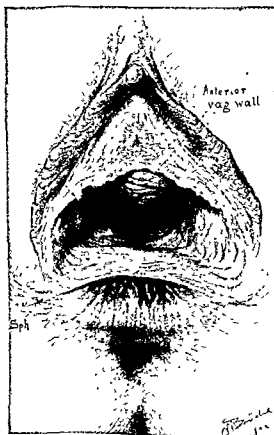


FIG. 124. Old 3rd-degree laceration. Note dimples on either side due to retraction of torn sphincter.

commonly a complete tear is discovered during a pelvic examination incidental to some other pelvic complaint, and frequently we are struck by the lack of complaint of incontinence. Upon direct questioning, such women will often reply that they have no difficulty in their naturally constipated state; only after cathartics are they really annoyed by the lack of a sphincter.

#### TREATMENT

Selecting the proper time for operating upon a complete perineal laceration is important. We believe that a larger percentage of cures will result if at least 6 months is permitted to elapse between the time of de-

livery and the operation. This gives the tissues sufficient time to return to normal, the operation will be easier to perform and, in our experience, the chances of success are enhanced.

Two general types of operation are used in the repair of complete lacerations: (1) *the layer method with or without rectal suture*; and (2) *the flap method as first described by Warren*. Slight modifications in both of these methods have been made from time to time by various gynecologists, but they are of no great significance. The only real addition to the original technic was made by Norman Miller who, since 1931, has advocated cutting the rectal sphincter latero-

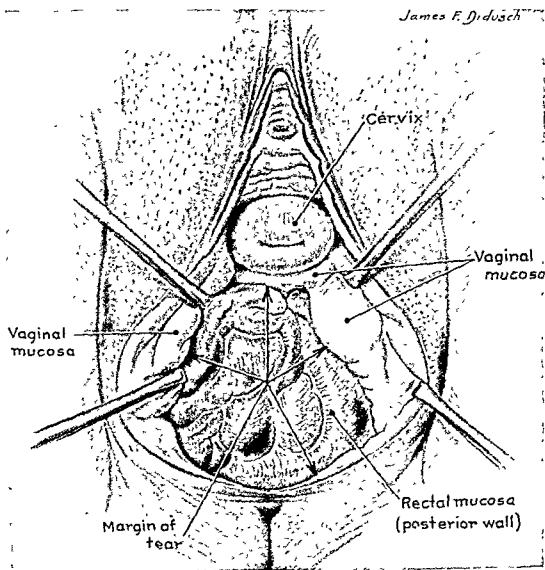


FIG. 125. Rectovaginal tear extending from the perineum almost to the cervix.



posteriorly to permit the free escape of gas and thus prevent tension on the sutures. Miller calls this sphincter cutting the "paradoxical operation." We have used it several times with success and believe that it is especially important to cut the sphincter in the more difficult cases, and particularly in those in which previous unsuccessful attempts at repair have been made.

It is our opinion that the Warren apron or flap method is the greatest single contribution to the cure of complete perineal laceration, and for this reason Warren's own description and his original portrayal of the method of dissecting the flap are reproduced here:

The flap is formed by dissecting the "butterfly" from within outward, preserving the materials just mentioned in one continuous mass, the pedicle being formed by the entire free margin of the septum, a hinge on which the flap is swung over so as to exclude the rectum from view. The dissection will be performed with greater ease and nicety if the knife is used, and should be made chiefly from the sides in the manner indicated. In reflecting the central portion it is important to avoid "buttonholing"; for this purpose it is well to keep the septum between the thumb and forefinger of the left hand, liberating the flap by gentle strokes of the knife to and fro, while the tissues are made tense by traction on the flap with the forceps in the hands of an assistant. The dissection should stop just short of the free margin so as to leave it intact, otherwise the pedicle of the flap would be severed; on the sides the dissection is carried out sufficiently far to expose the ends of the ruptured sphincter muscle.\*

It is obvious upon reviewing the results recorded in the literature that excellent results may be obtained by the layer method as well as by the flap method:

Smith and Linton. From the Woman's Free Hospital by the *layer method*:

Cured .....	89.3 per cent
Failed .....	1.8 per cent
Relieved .....	8.9 per cent

Phaneuf. Operation by the *layer method*:

Satisfactory . . . . .	87 per cent
Reoperation upon the remaining 13 per cent increased the satisfactory results to 97.8 per cent.	

Campbell. From University of Wisconsin Medical School, *flap method*:

Successful .....	95 per cent
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Miller and Brown report from the University of Michigan, dividing the cases done by the *Warren flap method* into two groups: those done before 1931 and those after 1931. In the latter group the sphincter was cut in most instances.

	BEFORE 1931	AFTER 1931
Function restored . . . . .	71%	87%
Function improved . . . . .	15%	8%
Failure .....	10%	5%
Unknown .....	5%	None

In considering the end results, the effect of future deliveries upon the reconstructed perineum should be considered. We always have taught that deliveries after a successful 3rd-degree perineal repair should be made by cesarean section. Smith and Linton's follow-up study on this point substantiates this viewpoint; they found that of those patients who had future vaginal deliveries, 21.2 per cent had a complete and 12.1 per cent a partial recurrence.

It is obvious from the above statistics that good results may be obtained by either of the two methods when the operations are performed properly by competent surgeons. The use of fine catgut and the avoidance of undue tension are essential, regardless of which method is used. In our clinic we are inclined to the Warren flap technic and use it in most cases, unless the tear up the anterior rectal wall is too long. In such cases a turned-down flap sufficiently long to cover the defect and protrude beyond the perineum would, of necessity, be so long that its blood supply might be imperiled, and there would exist the danger of sloughing. In such cases we suture the anterior rectal wall and close by the layer method.

During the past few years we have had remarkably good success in our surgical results with the use of sulfasuxadine (succinyl-

\* Warren, J. Collins: A new method of operation for the relief of rupture of the perineum through the sphincter and rectum, Tr. Am. Gynec. Soc. 72:324, 1882.

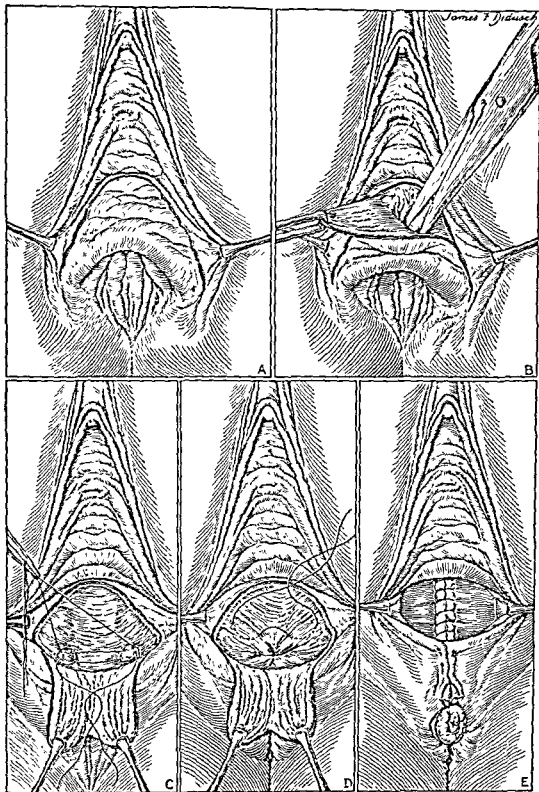


FIG. 126. Warren flap operation for 3rd-degree tear. (A) Indicating line of incision, outlining flap of vaginal mucosa. (B) The flap is being dissected free and turned back. (C) The flap is retracted downward. The ends of the sphincter have been delivered and are being sutured with interrupted sutures of medium silk. (D) The sphincter ends have been united and are buried by suturing the levator muscles together in the mid-line with No. 0 chromic catgut. (E) The vaginal incision has been closed with a continuous lock stitch that is continued subcuticularly over the perineum. The flap is thus rolled up. If too redundant, it may be trimmed off at a later time.

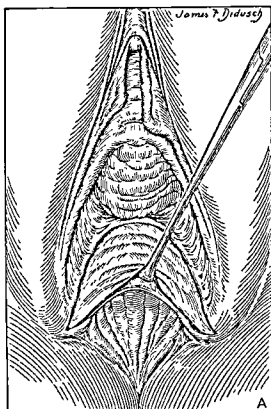


FIG. 127. Operation for 3rd-degree perineal laceration, layer method. (A) A transverse incision at the junction of the vaginal and the rectal mucosa has been made. An inverted V-shaped piece of mucosa is removed from the posterior vaginal wall. The size of this depends upon the redundancy of the mucosa.

sulfathiazole), both preoperatively and post-operatively. Before the expected date of operation the patient is given 24 sulfasuxadine tablets (0.5 Gm.) daily in divided doses. This produces a mild laxative effect, and the patient usually has 2 or 3 soft stools daily. If this regimen is carried out, the patient need not be placed on a liquid diet preoperatively. She is merely advised to eat rather lightly for a few days before operation. With this regimen the *Escherichia coli* content of the stool is reduced to almost nil, and per primum healing is the rule. A few hours before the scheduled time of operation the rectum is irrigated with sterile saline solution until the irrigating fluid returns clear. Then the rectum is instilled with 250 cc. of 1 per cent

neomycin solution. As soon as the patient's stomach is settled after operation, again she is given 12 Gm. of sulfasuxadine daily and placed on a light diet. About the 3rd post-operative day the bowels usually begin to move, and she continues to have a few soft stools per day. The drug is continued for about 2 weeks after operation. During this time the patient is permitted to eat solid food, avoiding a diet with great residue.

#### *Technic: Warren Flap Operation for 3rd-Degree Tear*

An inverted V-shaped incision is made in the posterior vaginal mucosa, outlining the flap which is to be turned down. The lower ends of the incision should be just lateral to the dimples caused by retracted sphincter ends (Fig. 126 A).

The flap of mucosa is dissected free from above downward (Fig 126 B). This should be done with care, to avoid injury to bowel wall, and the dissection should stop short of the margin of the vaginal and the rectal mucosa. If this margin should be perforated, the advantage of the flap technic would be nullified. If the flap has been demarcated properly, the areas overlying the sphincter ends will have been denuded.

Using Halsted clamps, the sphincter ends are fished for and delivered. They are sutured together with 2 or 3 interrupted sutures of medium silk (Fig. 126 C). It is well at this point for the operator to put a second glove on the left hand and insert a finger into the rectum to test the sphincter tone. If the operator is not satisfied with the sphincter tone, a further attempt should be made to find and approximate more sphincter fibers. The second glove is removed, and the sterile part of the operation continues as the turned-down flap, which is grasped with 2 mucosa clips, is allowed to hang down over the rectum.

The levator ani muscles are brought together with interrupted sutures of No. 0 chromic catgut (Fig. 126 D). These muscles re-enforce the sphincter fibers and build up the perineum. Then closure is carried out as in an ordinary perineal repair. The end of the mucosal flap eventually protrudes somewhat puckered by the approximated muscles

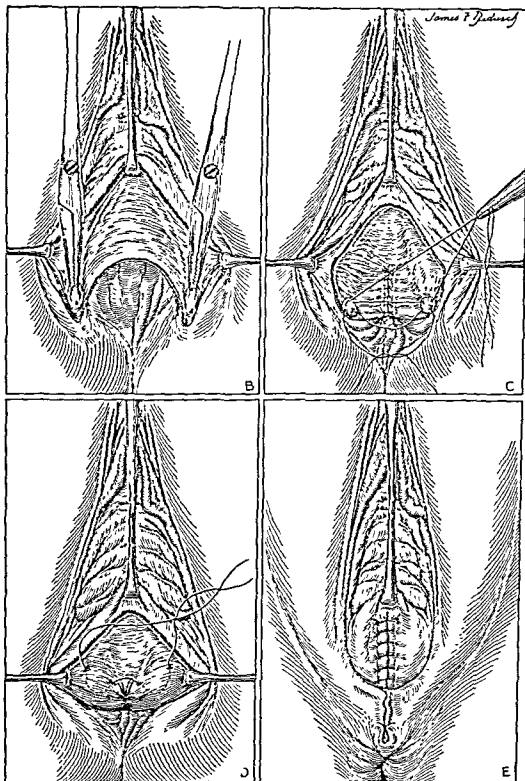


FIG. 127 (Continued). Operation for 3rd-degree perineal laceration. (B) The vaginal flap has been removed. The ends of the sphincter muscles have been delivered with Halsted clamps. (C) The rent in the rectal wall has been closed with a double layer of continuous No. 0 chromic catgut, inverting the edges into bowel lumen. (D) After approximating the silk sphincter sutures shown in E, the levators are brought together with deep interrupted sutures of No. 0 chromic catgut. (E) The vaginal incision is closed with a continuous lock stitch of No. 0 chromic catgut which is continued down subcuticularly to approximate the perineal skin.

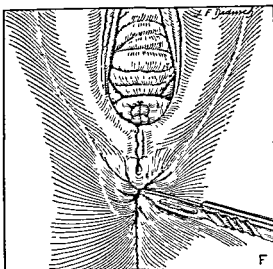


FIG. 127 (Continued). Operation for 3rd-degree perineal laceration. (F) Sphincter ani is cut at about 5 o'clock.

above it (Fig. 126 E). It should not be trimmed flush with the perineum at this time, for it may retract to some degree. If the protrusion is annoying it may be trimmed off later under local anesthesia.

#### *Technic: Layer Method of Repair of Complete Perineal Laceration*

An incision is made at the junction of the posterior vaginal wall and the rectal mucosa. An inverted V-shaped incision is made in the posterior vaginal wall, and the vaginal mucosa is removed (Fig. 127 A). The size of this V depends upon the redundancy of the vaginal mucosa. It should extend sufficiently far laterally at its base to denude the regions in which the sphincter ends are to be picked up. The ends of the sphincters are grasped with Halsted clamps (Fig. 127 B). The tips of the clamps are plunged down on either side to pick up the sphincter ends. The position of the sphincter ends can be estimated from the position of dimples in the skin caused by retraction of the ends of the sphincter (Fig. 127 A). It is difficult from inspection of the tissue caught in the clamps to judge whether or not one actually has grasped the sphincters. To test this the 2 tips of the clamps containing the tissue are brought together in the mid-line, and the sphincter action is tested by inserting

a finger in the rectum. To do this an extra glove is put on temporarily. Two interrupted sutures of Pagenstecher linen or medium silk are placed in the sphincter ends, but they are not tied at this time.

The rent in the rectum is closed, using a continuous suture of No. 0 chromic catgut. The suture (Fig. 127 C) is made by taking small parallel bites along the edge of the rent, being careful to include in each stitch a good bite of rectal wall, but not to perforate the mucosa. As this suture is drawn tight, the edge is inverted into the lumen of the bowel. If there is sufficient tissue so that it can be done without tension, a second suture line is desirable.

The sphincter ends are then united by tying the 2 interrupted nonabsorbable sutures. One or more deep interrupted sutures are taken into the levator muscles (Fig. 127 D). These sutures are tied, thus restoring the perineum and re-enforcing the sphincter sutures. The vaginal mucosa is then closed with a continuous lock stitch of No. 0 chromic catgut, which is continued over the perineum subcuticularly (Fig. 127 E).

The rectal sphincter may then be cut at 5 o'clock. In the more difficult cases, and particularly those in which previous operations have failed, we make this a rule and never have experienced incontinence as a result of it (Fig. 127 F).

## RECTOVAGINAL FISTULAS

### CAUSES AND SYMPTOMS

Rectovaginal fistulas result from a number of causes. Those due to any single cause are not many, but taken together they are sufficiently frequent to demand considerable attention from the operating gynecologist. Many occur as the result of unsuccessful attempts at repair of 3rd-degree tears when a bridge of tissue or the complete sphincter heals in the anterior sphincter region, while the repair above the sphincter breaks down. There results a low rectovaginal fistula of variable size (Fig. 128). Small and even moderate-sized fistulas can form as a result of injury done to the rectum at the time that a perineal operation is performed. In the better clinics this practically never occurs, but such cases are encountered from less

adequately trained surgeons. Even more rarely, injury to the rectum or the sigmoid takes place in the course of a total hysterectomy, and in such instances a fistula forms at the very top of the vagina. High rectovaginal fistulas result from irradiation of cervical cancer. These may be due to radium burns of normal tissue or to the destruction of carcinomatous tissue that has invaded the rectovaginal septum. We have observed sloughing of practically the entire rectal and posterior vaginal wall as the result of irradiation.

Perirectal abscesses, when opened spontaneously or surgically, may result in fistulas that open into the vagina. Attempted, unsuccessful repairs of such fistulas can result in other fistulas with more scar tissue.

Small rectovaginal fistulas may be entirely asymptomatic. A slight leakage of gas and seepage of feces may not be detected in the vaginal discharge. When the fistulas are slightly larger, the escape of gas may be the only complaint, or there may be the complaint of a slight fecal odor in the vaginal discharge. When the fistulas are large, the entire bowel content is evacuated through the vagina. Naturally, this is an extremely annoying condition but, as in women with 3rd-degree lacerations, voluntary constipation may reduce the amount of leakage. In our experience, relatively good control of feces by constipation is attained more often with 3rd-degree lacerations than with rectovaginal fistulas.

#### DIAGNOSIS AND TREATMENT

The diagnosis of rectovaginal fistula is usually very simple. By merely spreading the labia the condition may be disclosed, or a duckbill speculum usually can be rotated so as to show a higher fistula. The opening in the vagina may be filled with feces, or if the bowel has been emptied recently the dark rectal mucosa may be seen at the fistulous opening, in contrast with the pink vaginal mucous membrane. It may be exceedingly difficult to locate the opening in the rectum and the vagina when the fistulas are small. The location of both orifices is essential to the cure. A small probe may find its way through the fistula from the vaginal side and the tip be felt on rectal examination. If

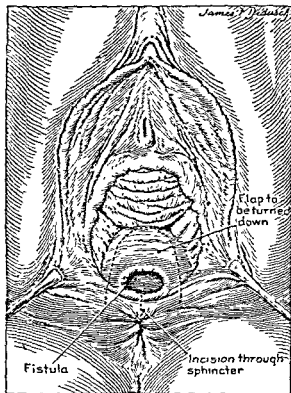


FIG. 128. Low rectovaginal fistula is converted into complete tear by cutting sphincter. Inverted U-shaped dotted line outlines proposed flap to be turned down.

difficulty is experienced in following the fistulous tract at operation, injection with methylene blue may aid. The small fistula, resulting from rupture of an abscess, is most apt to be troublesome in following. These postabscess fistulas may open between the anal sphincter fibers, and cutting of the fibers to lay open the fistulous tract is essential to cure.

Regardless of the type of operation to be done, it is apparent that healing is enhanced by reducing the colon bacillus content of the stool. For that purpose the patient is placed on a daily dose of 12 Gm. of sulfasuxadine for 5 days preceding the operation. A few hours before operation she is given rectal irrigations with sterile saline until the fluid returns clear, and then the rectum is instilled with 250 cc. of 1 per cent neomycin solution. After postoperative nausea ceases, the sulfasuxadine treatment is resumed; the postoperative routine is the same as that following repair of a 3rd-degree tear.

The surgical cure of a rectovaginal fistula may be exceedingly simple or quite complicated. Small fistulas may be closed by 2 or more purse strings as shown in Figure 129.

It is desirable to approximate broad surface to broad surface for healing, regardless of the exact technic of closure. A more-or-less standard technic for closure of a typical

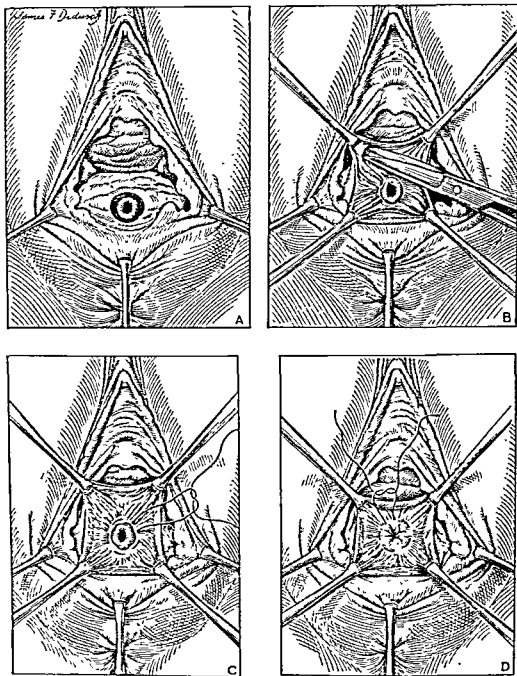


FIG. 129. Repair of small rectovaginal fistula. (A) A circular incision through the vaginal mucosa is made about the fistulous opening. (B) Flaps of vaginal mucosa are dissected free for about 2 cm from the margin of the fistulous opening. (C) A purse-string suture of No. 0 chromic catgut is placed about fistulous opening. (D) The first purse string has been tied, inverting the fistulous opening. The second purse string has been placed and is about to be tied.

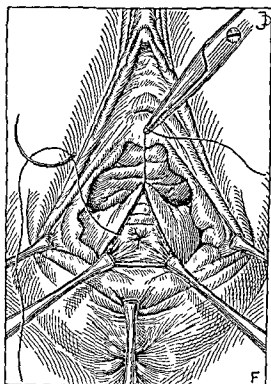
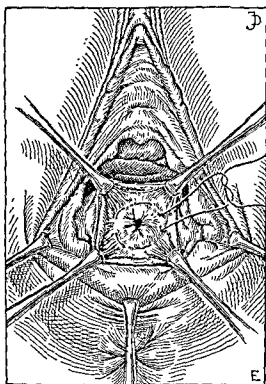
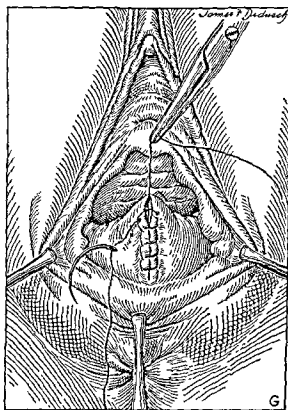


FIG. 129 (Continued). Repair of small rectovaginal fistula. (E) The second purse string has been tied, and a third has been placed. (F) Submucosal tissues are approximated with a continuous suture of No. 0 chromic catgut. (G) The mucosa is closed with a continuous lock stitch of No. 0 chromic catgut.



fistula in a layer-for-layer manner is shown in Figure 130. When the fistula is fairly large and lies just above the sphincter or the perineal bridge, usually it is wise to cut the bridge, thus converting the fistula into a 3rd-degree tear (Fig. 128). The 3rd-degree tear is then repaired by the flap method as shown in Figure 126.

Except in the simplest fistulas, we routinely practice the cutting of the sphincter at about 4 o'clock, at the conclusion of the operation, as described by Miller (Fig. 127 F). If this is done there is no pressure from the accumulation of gas in the rectum. This procedure, combined with the use of sulfasuxadine medication preoperatively and postoperatively, has noticeably increased our successes.

Very large and difficult fistulas often require more than the routine operation. We refer particularly to fistulas that occur after

irradiation and to those that, because of previous surgical attempts, have an excess of scar tissue. In such cases it is often essential to divert the feces from the field of operation



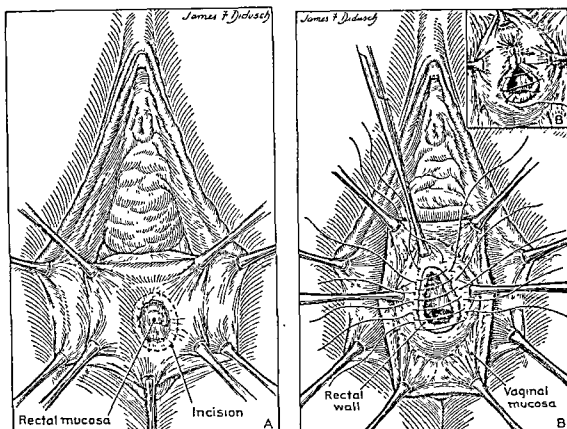


FIG. 130. Repair of rectovaginal fistula. (A) Shows the opening of the fistula in the posterior vaginal wall exposed and the incision indicated by a dotted line. (B) A broad flap of vaginal mucosa has been dissected away from the margin of the fistula. Interrupted mattress sutures have been placed about the margin of the fistula. When these sutures are tied, the fistulous opening will be inverted. B' shows the closure with a continuous suture.

by first performing a sigmoidostomy. We have found a modified Mikulicz procedure to be the best type of colostomy for this purpose (Fig 132). The bowel is completely transected to ensure perfect diversion of feces, and subsequent closure is simple. Finally, the rare rectovaginal or sigmoidovaginal fistulas resulting from bowel injury at the time of total hysterectomy and lying at the apex of the vagina may require transabdominal closure. Recently, we have closed such a fistula vaginally, using a technic similar to that described by Latzko for vesicovaginal fistulas following total hysterectomy. This technic is illustrated in Figure 131.

#### *Technic: Closure of Small Rectovaginal Fistula*

A small circular incision is made in the

vagina, encircling the fistulous opening (Fig. 129 A).

With small pointed-tip scissors the vaginal mucosa is dissected free for a distance sufficient to mobilize the bowel wall in order to permit closure of the opening in the bowel by 2 or 3 purse-string sutures without tension (Fig. 129 B). The first purse string is placed about the opening, a few millimeters from the edge, using No. 0 chromic catgut (Fig. 129 C). Care should be exercised not to permit perforation through the bowel mucosa in placing this suture. The edges of the fistula are inverted into the lumen of the bowel as the purse string is tied. A 2nd purse string is placed about the 1st (Fig. 129 D). If it can be done without tension a 3rd purse string may be placed around the 2nd (Fig. 129 E). The perirectal fascia is

then approximated in the mid-line, using a continuous suture of No. 0 chromic catgut (Fig. 129 F). The vaginal mucosa is excised, if redundant, and is closed with a continuous lock stitch of No. 0 chromic catgut (Fig. 129 G). If the fistula is closed easily, the sphincter is not cut, but if the fistula is closed with difficulty and especially if previous unsuccessful attempts have been made, the rectal sphincter may be cut as indicated in Figure 129 F.

*Technic: Closure of Larger Rectovaginal Fistula*

An incision is made around the fistulous opening through the vaginal mucous membrane, as indicated by the dotted line in Figure 130 A.

The vaginal mucous membrane is dissected back far enough to permit mobilization of the bowel for closure (Fig. 130 B). Since

the opening into the bowel is too large to be closed by a purse string, it is closed by a series of mattress sutures, as indicated in Figure 130. The bites in the tissue are taken parallel with the edges of the fistula but do not enter the lumen of the bowel. No. 0 chromic catgut is most suitable for these stitches. The closure can also be made with a continuous suture, inverting the edges into the bowel lumen as shown in Figure 130 B.

After the 1st layer of stitches is tied, it is reinforced by a 2nd layer placed in the same way but taking somewhat coarser bites (Fig. 130 C). These mattress sutures should be approximated gently and snugly, but not tight enough to strangulate the tissues. In this

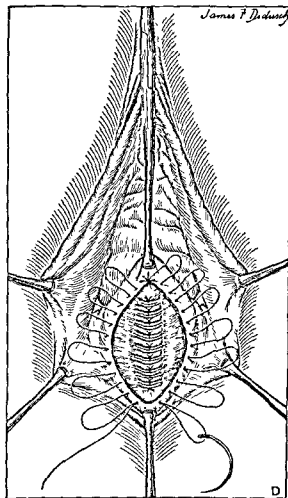
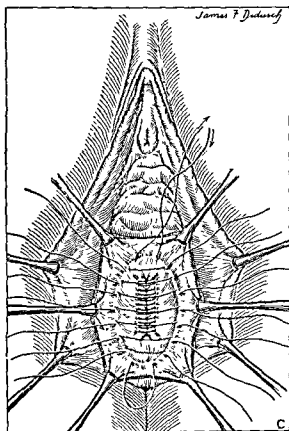


FIG. 130 (Continued). Repair of rectovaginal fistula. (C) Interrupted mattress sutures have been placed in the perirectal tissues. When tied, these sutures will invert the first row of sutures and approximate broad surface to broad surface for healing. (D) The mucosa is closed with a continuous mattress suture which picks up the subjacent tissue, thus obliterating dead space and everting the mucosal edges.

manner broad surfaces are brought together for healing.

After the 2nd layer of stitches has been tied, the edges of the vaginal mucosa are trimmed off, and the mucosal incision is closed with a continuous suture of No. 0 chromic catgut. This suture everts the edges of the mucosa and approximates broad new surfaces for healing. When this mucosal suture is taken, bits of the subjacent tissue are picked up with each bite, thus closing all potential dead space (Fig. 130 D).

In the large fistulas it is our custom to sever the anal sphincter, as indicated in Figure 127 F, to permit the free passage of gas and to prevent pressure on the operative incision.

#### *Latzko Technic: Closure of Large Rectovaginal Fistula*

The Latzko technic of using both the anterior and the posterior vaginal walls in the closure of vesicovaginal fistulas following total hysterectomy has a restricted use in the closure of selected rectovaginal fistulas. We have encountered a few large rectovaginal fistulas following hysterectomy for cervical carcinoma. These have occurred mostly in cases in which irradiation was first used, followed by a Wertheim type of hysterectomy. In such cases the interference with the blood supply by the surgery added to the already depleted blood supply resulting from irradiation is sufficient to cause sloughing of the rectal and the vaginal walls; consequently, fistula develops. Such a fistula may be large and surrounded by indurated, fibrosed tissue with poor blood supply. In that case the chance of cure by ordinary methods is poor. A sufficient area around the fistula must be denuded to approximate broad surfaces and also to approximate tissue which is well vascularized.

Figure 131 A shows incisions about the fistula. The area to be denuded includes both the anterior and the posterior vaginal walls. Figure 131 B shows the mucosa being removed; Figure 131 C, the 1st line of closure; the edges are inverted into the bowel lumen, using No. 0 chromic catgut. Figure 131 D shows the 1st suture line closed and the 2nd being placed; these sutures are of the mattress type, the bite of the needle being taken

parallel with the suture line. Finally, the mucosal edges are brought together with mattress sutures of silver wire. These sutures are left in place for 2 weeks. For their removal, the patient is anesthetized with Pentothal Sodium.

#### *Technic: Modified Mikulicz Sigmoidostomy for Diversion of Feces, in Repairing Difficult Rectovaginal Fistulas*

A lower-left rectus incision is made, and the sigmoid is delivered. If the mesosigmoid is very short, the bowel may be mobilized by cutting the peritoneum as it is reflected from the bowel to the parietal wall. The sigmoid need only be brought up enough so that a small knuckle will be above the level of the skin.

A tape is placed through the mesosigmoid, as indicated in Figure 132 A. This tape is left in place to act as a guide when the bowel is transected at a later time.

The antimesenteric surfaces of the bowel are sutured together with 2 parallel lines of interrupted sutures of fine silk, as shown in Figure 132 B.

The bowel is sutured to the parietal peritoneum with interrupted fine silk sutures (Fig. 132 C), and the wound is closed in a layer-for-layer manner (Fig. 132 D).

The bowel is anchored to the skin with a few interrupted silk sutures.

Forty-eight hours later the bowel is completely transected with the cautery, releasing the tape as the bowel is cut through. Only by complete transection can one be certain of perfect diversion of the feces.

About 10 days after opening the bowel, the fistula is repaired. In the 10-day interval the lower segment of bowel is irrigated daily with saline, both ways, to make certain that it is as free as possible of residual feces and mucus. A few hours before operation it is instilled with 250 cc. of 1 per cent neomycin.

About 6 weeks should be allowed for the repair of the fistula to heal firmly. Then the colostomy is closed.

This same method of fecal diversion may be used before repair of 3rd-degree tears when they appear to be especially difficult. This is very rarely necessary, but occasionally one sees cases in which several previous unsuccessful attempts have resulted in an ex-

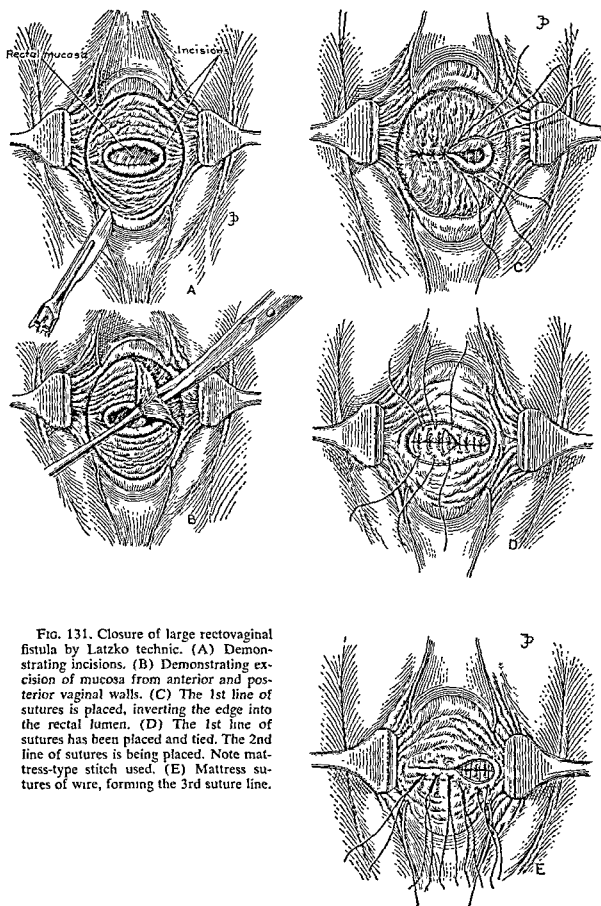


FIG. 131. Closure of large rectovaginal fistula by Latzko technic. (A) Demonstrating incisions. (B) Demonstrating excision of mucosa from anterior and posterior vaginal walls. (C) The 1st line of sutures is placed, inverting the edge into the rectal lumen. (D) The 1st line of sutures has been placed and tied. The 2nd line of sutures is being placed. Note mattress-type stitch used. (E) Mattress sutures of wire, forming the 3rd suture line.

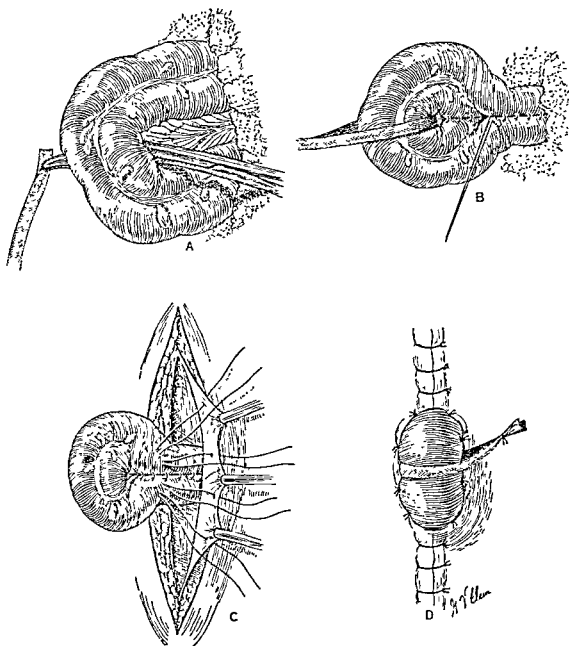


FIG. 132. Method of sigmoidostomy by Mikulicz principle preparatory to complete transection of bowel for diverting feces in preparation for repair of difficult rectovaginal fistula. (A) The sigmoid has been delivered, and tape has been inserted through the mesosigmoid. (B) The 1st row of interrupted silk sutures has been placed. The 2nd row is being placed. (C) The bowel wall is being anchored to the peritoneum with interrupted silk sutures. (D) The bowel wall is tacked to the skin edge with interrupted silk sutures. The tape is left in place for orientation in severing the bowel later.

cess of scar tissue. In making the final "all out" attack on such a surgical problem, fecal diversion greatly enhances the chances of success.

#### CONGENITAL RECTOVAGINAL FISTULAS

Congenital communication of the rectum with the vagina is, fortunately, a rare con-

dition. The communication may be small, or the full lumen of the bowel may open into the vagina. When the opening is small, the condition may be life-endangering, and a colostomy may be necessary to save the child's life. When the opening is the full width of the bowel lumen, complete incontinence may be present, but it is remarkable how little incontinence exists in some cases. Some of the patients control their bowels so well that surgery would scarcely be justified for the correction of the condition were it not for the disadvantage of the fistula at coitus. The vaginal opening may occur at any level in the vagina from the posterior fornix to the fourchette. Fortunately for the repair,

the majority open in the lowermost part (Fig. 133).

An understanding of this congenital developmental defect is best obtained by a consideration of the embryology of the parts. According to Harkin,

the allantois expands to form the primitive bladder, then courses anteriorly to open on the ventral surface of the embryo. The hindgut is at the level of and posterior to the primitive bladder. Caudal to this region the minute continuation and extremity of the intestinal tract is known as the tail gut. As early as the third week, the bladder and hindgut empty into a common cavity called the cloacal membrane. In the six-weeks' embryo the urogenital groove

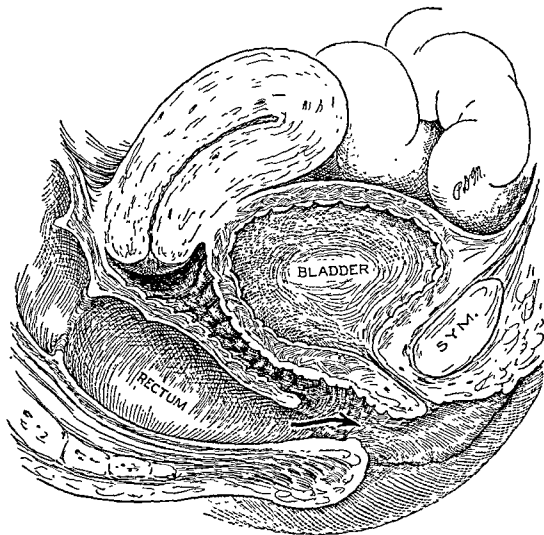


FIG. 133. Sagittal section showing congenital opening of rectum into vaginal vestibule.

is beginning to grow downward, and by the seventh week the urogenital and intestinal system have been partitioned by this groove. The cloacal membrane is then divided into urogenital and anal membranes respectively, and by the eighth week the urogenital membrane breaks down to establish an external opening. In the region of the future anus an invagination develops which is known as the proctodeum. Normally, the anal membrane ruptures during the eighth week to establish continuity between the proctodeum and the anus. Any failure of the anal membrane to break down results in an imperforate anus.

It is apparent that any arrest in the downward groove, which should separate the intestinal tract from the urinary system, will result in residual communicating fistulas.\*

The anal sphincters are derived from mesenchyme and therefore are independent in their development from the ectodermal and entodermal origins of the anus and the rectum. Harkin believes that most, if not all, of these patients are equipped with anal sphincters. This is a point of great surgical interest and may account for the perfect sphincteric action obtained when the rectum is brought down into its correct place. However, the presence of true rectal sphincter fibers is difficult to prove, for it seems probable that the closely approximated levator ani muscles might give quite adequate fecal control when the rectum is transplanted between them.

### TREATMENT

The time of the treatment is important. It is probable that many pediatric surgeons would disagree with us on the time at which correction of this condition should be undertaken. From our experience we would strongly favor waiting until the child has reached puberty before attempting the operation. Before that time the parts are so small and the vaginal mucosa so delicate that dissection is difficult, and the operation is apt to be doomed to failure. A second operation

is always done with greater difficulty due to scar tissue resulting from the first.

The treatment consists of bringing the rectum down to the normal anal region and closing the opening in the vagina. It is best to defer operation until after puberty to permit the vagina to enlarge enough to allow intravaginal work. The operation described here was done on a 15-year-old colored child. The procedure originally carried out for this condition was described by Rizzoli, who made an incision from the fistula through the vagina and the perineum to the position where the anus was to be transplanted. The bowel was brought down into the new position, and the vaginal and perineal wound was closed. The operation described here was done by E. H. Richardson, Jr., and the author, who believe it to be the logical method of dealing with the condition. It has the obvious advantage over Rizzoli's operation in that nothing is done to interfere with the sphincter action of the closely approximated levator ani muscles or of the sphincter ani, if such is present, as believed by Harkin. The result in the case herewith described was excellent, including perfect sphincter action. On investigating the literature in the course of writing this book, the author found that Stone had described this same operation in 1936 and reported 3 cases operated on successfully. Stone gave medication to tie up the bowels for from 7 to 10 days after the operation. We place the patient on a daily dose of 12 Gm. of sulfasuxadine for 5 days preoperatively. On the morning of operation the bowel is irrigated with saline solution until it returns clear. Then 250 cc. of 1 per cent neomycin solution is instilled into the bowel. We begin sulfasuxadine again as soon as postoperative nausea ceases and continue it for about 2 weeks. As a rule, a spontaneous bowel movement occurs on the 3rd or the 4th postoperative day, and the patient has 2 or 3 soft movements daily as long as she is on the drug.

*Technic: Operation for Formation of Anus for Correction of Congenital Opening of Rectum into Vaginal Vestibule*

Figure 134 A shows the congenital condition as it exists. The rectum opens into the

\* Harkin, Dwight E.: Congenital malformations of the rectum and anus, *Surgery* 11:423, 1942.

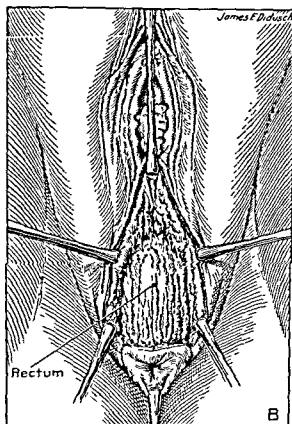
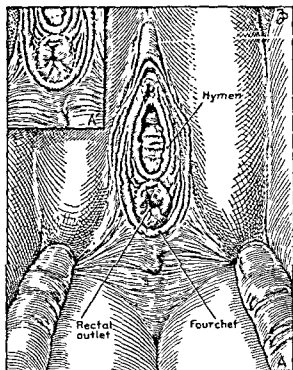
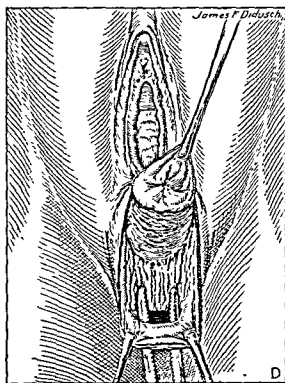
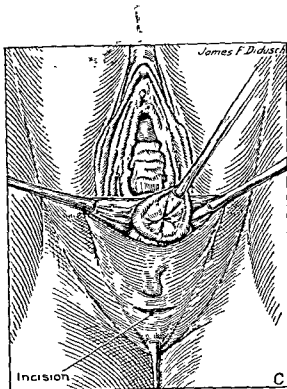


FIG. 134. Operation for congenital opening of the rectum into the vagina. (A) Preoperative condition. (A\*) Inset indicates line of incision. (B) After encircling the rectum it is mobilized for a distance sufficient to permit it to be delivered through the new opening. (C) A transverse incision is made for the anal opening. (D) After the levator ani muscles are separated in the mid-line a Kelly clamp is inserted for withdrawal of the rectum.





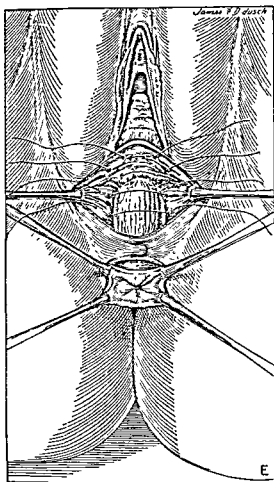
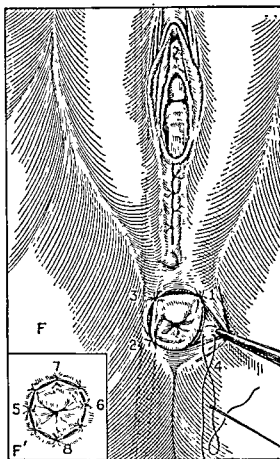


FIG. 134 (Continued). Operation for congenital opening of the rectum into the vagina. (E) After the rectum is withdrawn through the anal opening the tissues are brought together over the anterior rectal wall by interrupted No. 0 chromic catgut sutures. (F) The incision in the vaginal vestibule and the perineum has been closed. The margins of the rectum are sutured to the skin margins to form a new anus. (F') Suturing is complete.



distance to permit it to be drawn down to its normal site (Fig. 134 B).

A transverse incision is made in the perineal region through the skin and the fat in the position of the normal anus (Fig. 134 C).

A mid-line incision of about 1 inch is made between the levator muscles and is stretched open by a Kelly clamp (Fig. 134 D). The edge of the rectal mucosa is grasped with Allis clips, and the rectum is withdrawn through the new opening (Fig. 134 E). This should be possible without tension if the rectum has been mobilized properly, but the rectum should not be mobilized any higher than necessary to minimize interference with its blood supply.

As the rectum is held in its new position by means of mucosa clips, the vaginal vestibule wound is closed, first with interrupted sutures of No. 0 chromic catgut approximating the deeper tissues (Fig. 134 E), then with

vaginal vestibule and is without any sphincter musculature. The rectum and the vagina are separated by a thin septum above the congenital opening. The perineum is solid, formed by the union of the levator ani muscles in the mid-line. Figure 134 A shows the circular line of incision about the rectal opening.

The rectum is mobilized for a sufficient

similar sutures approximating the mucosa.

Finally, the rectal mucosa is sutured to the skin edges of the newly formed anus with interrupted sutures of fine silk (Fig. 134 F). The patient of whom these drawings were made had perfect sphincter action following the above procedure, and the anal region is scarcely distinguishable from a normal one.

### Rizzoli Operation

Since the first edition of this book we have had a failure with the operation described above, owing to retraction of the anus and re-establishing of a rectovaginal fistula. Therefore, we later performed a preliminary transverse colostomy. After cleaning out the distal loop of colon by daily irrigations for approximately 10 days, we performed the Rizzoli operation as shown in Figure 135. In the presence of scar tissue from the pre-

vious operation we were able to get better exposure by cutting down through the perineum and thus we could dissect the anus and the rectum with ease up to the peritoneal reflexion. It is our belief that the first type of operation described in this chapter may be done with frequent success, but if there is difficulty in freeing the anus and the rectum sufficiently to bring the anus down to the perineal opening without tension, cutting of the perineum as suggested by Rizzoli may facilitate the freeing of the bowel. Also, when previous surgery has been done, resulting in scar tissue, the Rizzoli type of operation may be done to advantage. Although either type of operation will often be successful with preoperative bowel sterilization without colostomy, when a previous unsuccessful operation has been done, preliminary colostomy is advisable.

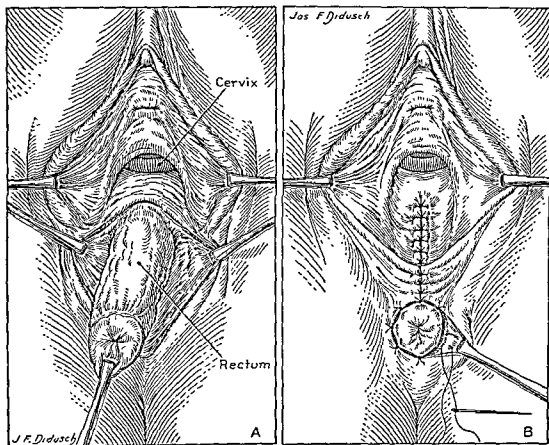


FIG. 135. Rizzoli operation for congenital rectovaginal fistula. (A) The incision has been carried through the perineum, and the anus has been dissected free. (B) The anal margin has been sutured to the skin, and the perineal incision has been closed.

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# The Anus and the Rectum in Relation to Gynecology

## GENERAL CONSIDERATIONS

The anus and the rectum should be examined routinely as a part of the general gynecologic examination. In doing this, anal or rectal disease is often discovered. As a matter of fact, the anal or rectal disorder is not infrequently responsible for the symptomatology. It is not uncommon for a patient to be uncertain as to the source of slight bleeding.

The author does not advocate the inclusion of proctology in the field of gynecology. There is no doubt that major rectal surgery can be done better by those who are particularly trained for it. However, a certain amount of minor anal and rectal surgery is forced upon the gynecologist, and he should be competent to do it. As a matter of fact, most gynecologists are not enthusiastic about rectal surgery; hence, they are apt to neglect associated anorectal conditions, with the result that the patients are not completely relieved. When a person is not enthusiastic about a thing, he is apt not to do well, and it has been our observation that the incidental rectal operations are not done with the care and the precision with which the gynecologist does the strictly pelvic part of the operation. With the thought of improving the anorectal surgery that is thrust upon the gynecologist, the author has written the material contained in this chapter.

In addition to the rectal conditions discussed elsewhere in this volume, such as 3rd-degree perineal tears and rectovaginal fistulas, there are other conditions commonly found in gynecologic patients. Some of them have a common etiology with the gynecologic condition, while in others the gynecologic

lesion has caused the rectal condition. Child-bearing, for example, is one of the greatest factors in hemorrhoid formation, and pelvic tumors by pressure may cause hemorrhoids.

The question of the desirability of combining gynecologic and rectal operations at the same anesthesia often arises. We frequently combine hemorrhoidectomy with perineal plastic operations. It is with great reluctance that we combine hemorrhoidectomy with laparotomy.

If hemorrhoids are responsible for serious symptoms in a patient requiring pelvic laparotomy, it is better to remove them some days after the laparotomy. Following vaginal plastic procedures, intestinal distention is seldom great, whereas with laparotomy it is often sufficiently annoying to necessitate frequent enemas. To utilize the rectum for repeated enemas following a hemorrhoidectomy greatly adds to the patient's post-operative pain. Fistulas in ano, requiring operation, should be operated upon a week or more before the laparotomy is done. Then during the hospital convalescence the operative site of the fistula may be irrigated and cared for while the patient is convalescing from the laparotomy.

## ANATOMIC CONSIDERATIONS

The anal canal, or terminal portion of the digestive tract, is of ectodermal origin, being preceded embryologically by the proctodeum. The base of the proctodeum or anal plate normally undergoes dissolution, and the rectum and the anus become continuous. Being of ectodermal origin, the anal canal is lined by stratified squamous epithelium which is somewhat modified in the upper part. The

canal is variable in length, but on an average is approximately 1 inch. The upper limit is the pectinate line, which represents the remains of the anal plate (Fig. 136). The lower limit is the anal verge, the junction of the anus with the perianal skin. This junction is somewhat indefinite, grossly and microscopically. The pectinate line is quite definite, being formed by small irregular elevations, the anal papillae (Fig. 136). On the inner side of these papillae are the crypts of Morgagni. The stratified squamous epithelium extends over the papillae into the crypts where it becomes modified and finally is replaced by columnar epithelium which lines the rectum.

On the rectal side of the pectinate line are several mucosal projections, running longitudinally to the lumen of the bowel, the columns of Morgagni. The rectum varies considerably in length. The lower limit is the pectinate line, and the upper limit is at the level of the 3rd sacral vertebra. The junction with the sigmoid is usually spoken of as the rectosigmoid and is the narrowest part of

the large bowel. The lumen of the rectum is encroached upon by transverse crescentic mucosal folds, 3 or 4 in number. These are known as the valves of Houston and are important landmarks in proctology.

The sphincter action of the anus is dependent upon the external voluntary sphincter and the internal involuntary sphincter. The external sphincter, composed of striated muscle, surrounds the lower part of the anus. The internal sphincter is simply an exaggeration of the circular smooth muscle fibers of the lower end of the rectum, beginning a little above the level of the pectinate line. There is some overlapping of the internal and the external sphincters, since the external encircles the lower portion of the internal sphincter. By digital palpation a groove can be felt between the margins of the two sphincters. This intersphincteric line is about halfway between the anal verge and the pectinate line (Fig. 136).

The anus is supported by the levator ani muscles, the perineal body and the anococcygeal raphe, extending from the posterior

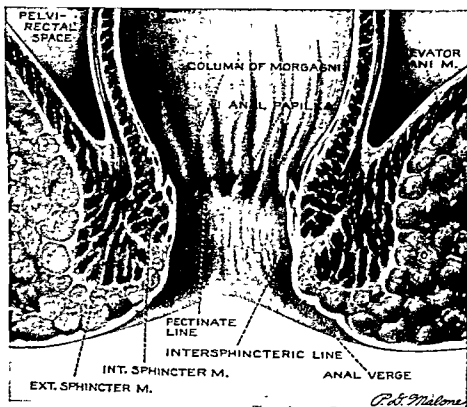
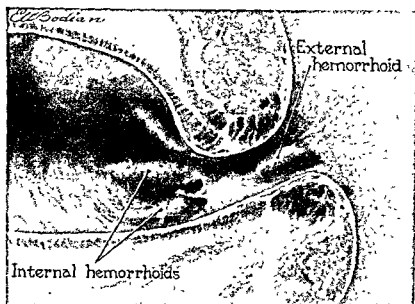


FIG. 136. Normal anatomy of anus and lower rectum.

Fig. 137. Showing position of external and internal hemorrhoids.



margins of the anus to the tip of the coccyx. The levator muscles arise on either side from the superior pubic ramus, the white line of the obturator fascia and the ischial spine. All the fibers pass medially and posteriorly. The anterior fibers insert into the sides of the vagina and the perineal body, the middle fibers into the anal walls between the internal and the external sphincters, and the posterior fibers insert into the anococcygeal raphe and the coccyx. When the levators contract, they draw the vagina, the perineal body, the anus, the anococcygeal raphe and the coccyx forward and upward.

The levator muscles, covered by fascia, form the floor of the pelvirectal spaces on either side of the rectum, as shown in Figure 136. The roof of these spaces is formed by the peritoneum. The spaces below the levator muscles on either side are the ischio-anal spaces. They are bounded laterally by the obturator fascia; superiorly and medially by the anal wall and the fascia covering the inferior surface of the levator muscles; and inferiorly by the skin. The spaces are normally filled with fat and fibrous tissue. Between the rectum and the sacrum is the retro-rectal space that is limited laterally by the rectal stalks, the vertical sheets of fascia separating this space from the lateral pelvirectal spaces.

The anus receives its blood supply from the perineal arteries and the inferior hemorrhoidal arteries which arise from the internal pudendal arteries as they pass above the

ischial tuberosities. The rectum receives its blood supply from the middle hemorrhoidal arteries which arise from the anterior trunks of the hypogastric arteries and from the superior hemorrhoidal artery, the terminal branch of the inferior mesenteric which ends in the upper part of the rectum.

The venous drainage of the anorectal region begins in the hemorrhoidal plexus that surrounds the anus and the rectum. It consists of two parts: the internal in the submucosa and the external outside the muscular coat. The internal presents a series of dilated pouches, which have a circular arrangement immediately above the anal orifice. The lower part of the external plexus is drained by the inferior hemorrhoidal veins into the pudendal veins. The midportion of the plexus drains into the middle hemorrhoidal veins, which join the hypogastric veins, and the upper portion of the plexus is drained by the superior hemorrhoidal vein, which is the beginning of the inferior mesenteric vein, part of the portal system. Thus it is apparent that through the hemorrhoidal plexus there is a communication between the portal and the caval systems.

## HEMORRHOIDS

### GENERAL CONSIDERATIONS

Hemorrhoids are varicose tumors involving the radicals of the inferior, the middle and the superior hemorrhoidal veins. They are covered with rectal mucosa or perianal skin and frequently become manifest clini-

cally by hemorrhage or prolapse. They are best classified as external, internal and externo-internal, the last being a combination of the other two (Fig. 137). Internal hemorrhoids arise in the rectal canal and are covered with mucosa. External hemorrhoids arise in the anal canal or the perianal region and consequently are covered with skin. The externo-internal hemorrhoids, which arise from veins above and below the pectinate line, are the most common type encountered, and their covering is partly mucosa and partly skin.

Internal hemorrhoids appear grossly as longitudinal vascular mucosal folds extending upward from the pectinate line. External hemorrhoids may manifest themselves as small tumors about the anus or may lie within the anal canal and appear externally only on straining. Microscopically, hemorrhoids consist of a conglomeration of dilated venules, a few small arterioles, connective-tissue stroma, some inflammatory cells and a covering of skin, mucosa or both. External hemorrhoids are apt to be less vascular and more fibrotic than the internal type. More or less completely fibrosed hemorrhoids about the anal margin are known as skin tags. They form from the organization of old extravasated blood complicated by infection.

### ETIOLOGY

In considering the etiology of hemorrhoids, one must recall that the superior hemorrhoidal vein, which is part of the portal system, is without valves. Hence, the terminal venules must support a long column of blood without the aid of valves along its course. The majority of varicose veins make their appearance between the ages of 25 and 50, the period of greatest physical activity. They are about twice as prevalent in men as in women because of greater physical activity, in spite of the factor of childbirth. However, the role of childbirth is demonstrated by the fact that at the Mayo Clinic 85 per cent of hemorrhoids occurring between 20 and 30 were in parous women. Overeating, constipation, the habitual use of strong cathartics and excessive straining at stool are all conducive to venous distention and varicosity formation. Buie believes that infection plays

an important role in the production of hemorrhoids. He visualizes infection entering the anorectal tissues from abrasions caused by straining at stool, during parturition and at hard manual labor. The venous walls become involved in the infection and are thus weakened and subject to dilatation at straining. Finally, the dilatation becomes permanent, and hemorrhoids result.

### SYMPTOMATOLOGY

A large percentage of hemorrhoids are asymptomatic. This applies to both the external and the internal variety, but particularly to the uncomplicated internal type. Bleeding and protrusion are the most common complaints resulting from internal hemorrhoids. The bleeding may vary from small blood streaks, seen in the formed stool, to massive hemorrhage of bright blood. The regular loss of even a small amount of blood exerts a cumulative effect, and a moderate or even extreme anemia may result. When internal hemorrhoids are very large, there may be a sense of fullness and incomplete defecation. Protrusion, at first, usually occurs only occasionally at stool. Then the protruded mucosal mass is grasped by the sphincter and it becomes necessary for the patient to replace it digitally. While prolapsed, itching is a common symptom. Finally, the hemorrhoids are constantly down unless the patient reclines; as edema, ulceration and infection develop, the mass often becomes strangulated. Thromboses develop in the strangulated mass, and eventually even gangrene may occur. The pain with these complications is often excruciating. If there is a cutting pain at or following defecation, it is usually due to a complicating fissure.

External hemorrhoids are usually associated with internal hemorrhoids and form part of the clinical picture. When they occur alone and are uncomplicated, they seldom give rise to significant symptoms. Sometimes pruritis or a scratchy feeling about the anal margin may be annoying. However, when thrombosis occurs in external hemorrhoids, they become extremely painful. These thromboses may be within the lumina of the vessels, but in some instances the vessel wall is broken, and extravasated blood becomes

clotted in the perivascular tissue. Edema occurs in the perivenous tissue, and the swelling is extremely painful.

### DIAGNOSIS

In making the diagnosis of internal hemorrhoids one should not rely on the palpating finger. Unless the hemorrhoids are fibrotic or edematous they cannot be palpated because they are so easily compressible. It is our practice to place the patient in the Sims lateral position and retract the buttocks as the patient bears down. Often the hemorrhoids can be made to protrude easily. If not, and if there is reason to suspect hemorrhoids from the symptoms, a tubular anoscope is passed, and the region is inspected. External hemorrhoids are not always visible until the patient has sat on a toilet and strained for a time. When there is prolapse and/or thrombosis of internal hemorrhoids, they are seen as purplish masses covered with edematous and often ulcerated mucosa. The edema may make the reduction impossible. A thrombosed external hemorrhoid appears as a very sensitive swelling outside the anal verge. The pain is often severe, and the patient begs for relief. The dark blood clot usually can be seen beneath the skin, but marked edema may obscure it. Generally, the clot can be palpated, varying in size from a BB shot to a pea.

### TREATMENT

The majority of the hemorrhoids seen in gynecologic patients are asymptomatic and require no treatment. Occasionally, a large asymptomatic hemorrhoid may be removed prophylactically at the conclusion of a vaginal plastic operation. The medical treatment of hemorrhoids has a distinct place when symptoms are not of sufficient severity or duration to warrant surgery or when it is necessary for one reason or another to defer surgery. Not uncommonly, symptoms arise while the patient is in bed, recuperating from a gynecologic operation. The frequent use of the rectal tube may be responsible for this. Also during pregnancy the pressure of the gravid uterus on the venous trunks causes hemorrhoids to appear and give rise to symptoms that are temporarily annoying. These

symptoms often disappear after delivery and, except in case of emergency, surgery should be deferred and palliative treatment tried. It is doubtful whether medical treatment ever causes well-developed hemorrhoids to disappear, but ulceration, infection and edema, which are the cause of the symptoms, often may be relieved. One of the first things to accomplish is to lubricate the stools well with mineral oil with the addition, if necessary, of a mild laxative such as milk of magnesia. The injection of 3 ounces of olive or mineral oil into the rectum before retiring aids the morning bowel movement. Anusol suppositories are soothing and should be inserted at bedtime. Unguentum gall et opii applied externally and up into the rectum gives relief, as does Nupercainal ointment. Rest accelerates relief of symptoms; if symptoms are severe, bed rest is desirable. Patients may get relief from an ice cap, but often sitz baths and hot moist applications are more effective.

When the symptoms are sufficiently persistent or severe to necessitate more than palliative measures, surgery is indicated. Although many excellent proctologists use the injection method of treatment, to us the procedure seems to be unsurgical and not without the possibility of serious complications. Since hemorrhoidal surgery is quite satisfactory, why should one employ a method that offers less chance of permanent cure and a greater chance of complications? Operative treatment is done for hemorrhoids of 3 types:

1. Thrombosed single hemorrhoid.
2. Symptomatic internal or externo-internal hemorrhoids.
3. Prolapsed and strangulated internal hemorrhoids.

#### *Operative Treatment of Thrombosed External Hemorrhoids*

In trifling cases some of the palliative measures described above may give relief, but often when temporary relief is attained more clots may form, and prolonged treatment with uncertain outcome is a poor substitute for the certain prompt relief of surgery.

The patient usually comes to the office or the outpatient department in acute distress. Without preliminary preparation, she is placed on the table in the Sims position. The operative region is swabbed with 1 per



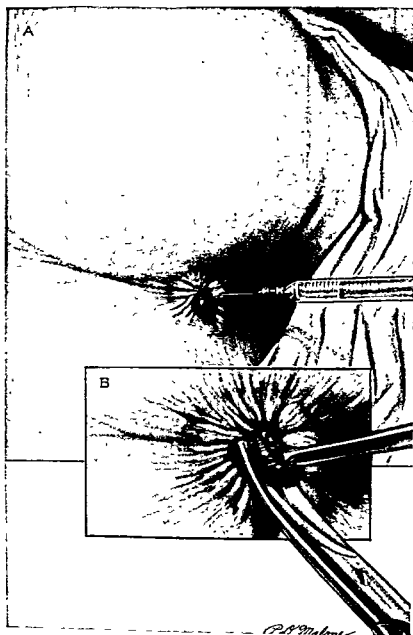


FIG. 138. Excision of a thrombosed external hemorrhoid. (A) The base of the hemorrhoid is infiltrated with Nupercaine, 1-500. (B) The hemorrhoid is excised.

cent aqueous solution of merthiolate. Using sterile Nupercaine solution (1-500) in a hypodermic syringe and a No. 25 or 26 caliber needle, a wheal is made in the skin at the base of the hemorrhoid (Fig. 138). The needle is advanced into the mass as more Nupercaine is injected. The hemorrhoid is picked up with a thumb forceps or an Allis clamp and excised with curved scissors (Fig. 138). If more clot is seen in the base of the wound, it is picked out with the thumb for-

ceps. The skin margins of the wound fall together but are not sutured. Rarely, a spurting arteriole requires ligating, but usually a gauze dressing controls the ooze. The patient is advised to take sitz baths 2 or 3 times daily at home and to apply petrolatum or Nupercaine after each bath. A half grain of codeine may be helpful to the patient during the first postoperative night, but usually she feels greatly relieved of her preoperative acute pain.

**Operative Treatment of Symptomatic But Uncomplicated Internal and Externointernal Hemorrhoids**

Hemorrhoids of this type are excised radially in our clinic with satisfactory results, regardless of the extent of the involvement of the hemorrhoidal veins. We prefer this method of excision to the operation described by Whitehead in 1882. His operation consisted of total excision of the hemorrhoidal area, namely the lower  $1\frac{1}{2}$  inches of rectal mucosa. The operation appealed greatly to surgeons, and during the early part of the present century was done extensively in this country. The percentage of anal strictures following it was high, and now the operation is only of historic interest. It is mentioned here only as a warning to young surgeons whose fancy may be caught by this operation, which has a strong appeal on theoretical grounds.

**Technic: Radial Excision.** It is desirable to have the bowel as nearly empty as possible before the operation is performed. A mild laxative given the night before and a soapsuds enema given at least an hour before the scheduled operation usually accomplishes this. An excellent alternate preoperative preparation is to give sulfasuxadine for a few days before operation, as described in the

chapter on 3rd-degree tears. Sulfasuxadine softens the stool and usually gives 3 or 4 easy movements per day. The continuation of this therapy after operation results in an easier postoperative course. The germicidal effect of the drug upon the colon bacillus is advantageous but not necessary for the healing of the hemorrhoidal wound. If only the hemorrhoidectomy is to be done, the patient is anesthetized with Pentothal Sodium. If the hemorrhoidectomy is to be done with an extensive plastic operation, sometimes other agents are used to supplement the Pentothal Sodium.

The patient is placed on the table in the lithotomy position. The anal sphincters are gently stretched digitally. Then the anal margins are grasped with Allis clamps and retracted. A dry sponge is pushed up into the rectum and then withdrawn. This cleans away the mucus from the operative region and everts the internal hemorrhoids. Even with extensive internal hemorrhoids they usually group themselves into 3 or 4 masses of varicosities. Each group is grasped with an Allis clamp and retracted out of the way as the mass to be excised first is clamped radially with a Kelly clamp (Fig. 139 A). Beginning just internal to the tip of the Kelly clamp, a continuous suture of No. 0 chromic catgut

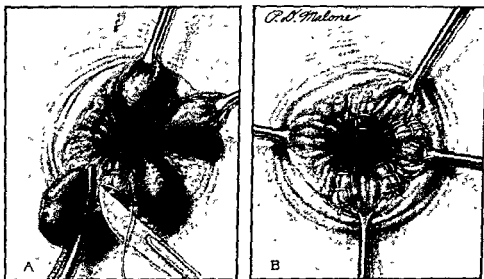


FIG. 139. Typical radial operation for internal hemorrhoid. (A) Groups of hemorrhoids are retracted with mucosa clips, and one mass of hemorrhoids is being excised. (B) The wounds have been sutured with continuous lock stitch of No. 0 chromic catgut.

is anchored in the rectal mucosa. Then a bit of the hemorrhoid beneath the Kelly clamp is cut and sutured with a continuous lock stitch. This cutting and suturing is continued, as shown in Figure 139 A, until the entire hemorrhoid is excised. This process of radially clamping, cutting and suturing is repeated until all of the masses of varicosities are removed, leaving radial wounds sutured with lock stitches with strips of mucosa between them (Fig. 139 A). If external hemorrhoids are also present, the redundant tissue about the anal margin is excised in radial elliptical pieces. The skin is allowed to fall together without suturing. If spurting vessels are encountered, each is ligated with fine catgut. A gauze sponge covered with petrolatum is inserted into the rectum as a plug. Usually, this is removed before bedtime for the patient's comfort.

Postoperatively, no attempt is made to tie up the patient's bowels. If the sulfasuxadine routine has been used, the drug is begun again the day after operation and is continued for about a week. The morning of the 2nd day an ounce of mineral oil is given and continued for several days. The morning of the 3rd day an ounce of Rochelle salts is given. The patients are usually more comfortable if kept on liquid diet, without milk, cocoa, or grape juice until the bowels move. After the first bowel movement, no restrictions are placed on the diet. After the first bowel movement, the patient is given a sitz bath 3 times daily and after each stool. Petrolatum or Nupercainal is applied to the anus after each bath. If a satisfactory bowel movement is not had by the 4th day, the patient is given a retention enema of 3 ounces of mineral oil at bedtime through a soft-rubber catheter. At the end of a week a digital examination is made gently. This is painful but prevents adhesion formation and constriction. It should be repeated in a week, and if there is any tendency to stricture formation it should be repeated as frequently as necessary until all tendency to contraction has vanished.

#### *Treatment of Prolapsed and Strangulated Internal Hemorrhoids*

Prolapsed and strangulated internal hemorrhoids soon become edematous and thrombosed as the rectal sphincter clamps down.

If seen early by the physician, he should attempt to replace them. The patient is placed in the Sims position, and the mass is bathed in cold water. Petrolatum is applied to the gloved finger of one hand, and the apex of the mass is pushed up as pressure is made on the marginal masses with the fingers of the other hand. The patient is put to bed, with a compress placed over the anus. If replacement is not accomplished promptly and maintained, it is useless to persist in attempts, because gangrene will soon result. Before the process advances too far, it is best to proceed promptly with a hemorrhoidectomy, using the technic described above. Relief is prompt and usually permanent.

## CRYPTITIS AND PAPILLITIS

### GENERAL CONSIDERATIONS

Forming the pectinate line are several elevations of skin known as papillae. Between the columns of Morgagni and overhung by the papillae are pockets of mucosa forming the crypts of Morgagni (Fig. 136). The position of these crypts and papillae makes them particularly susceptible to infection from the feces. Constipation, diarrhea or the excessive use of cathartics may bruise and irritate these structures and permit the entrance of infectious material into the tissues. Inflammation of the anal crypts usually extends to the adjacent papillae, which become edematous, fibrosed and hypertrophied. One of the most important points in connection with the pathology of papillitis and cryptitis is the fact that infection in this region may extend to the surrounding tissues and be the origin of fissures, fistulas, hemorrhoids or ischioanal abscesses.

### SYMPTOMS

The symptomatology of cryptitis and papillitis is often rather vague. As a result of this, proctologists differ in their interpretation of the relation of minor changes in these structures to symptoms. There seems to be little doubt that many proctologists have been too ready to interpret minor changes in the papillae and the crypts as being responsible for vague rectal symptoms that are probably neurotic in origin. Among these is the crawling sensation in the anorectal region not uncommonly complained of by neurotic

patients. However, inflammation of these structures may give rise to burning, aching sensations and, at times, short lancinating pains. Due to the local irritation, spasm of the sphincter may occur and aggravate constipation.

### DIAGNOSIS

The diagnosis of cryptitis and papillitis is made by digital and anoscopic examination. Occasionally, a large fibrosed papilla may be visible protruding from the anus. More often the hypertrophied papillae can be felt by the palpating finger. An infected crypt shows a variable degree of sensitivity to palpation, depending on the acuteness of the inflammation. Examination through an anoscope may show hypertrophied papillae, and the mucosa about the inflamed crypts appears red and edematous. Crypts may be searched with a small probe, bent like a shepherd's crook. Normal crypts are not very sensitive when probed, but a diseased crypt is tender when explored. If a sinus has developed from the crypt, the point of the probe may end in a skin tab.

### TREATMENT

Medical treatment consists of keeping the stool soft with mild laxatives, such as mineral oil, and taking warm water enemas after defecation. Petrolatum can be applied by the patient's finger covered with a finger cot after

cleansing the bowel. Metaphen or witch hazel may be instilled by the physician. Surgery is rarely indicated, but when operation becomes necessary, the patient is anesthetized with Pentothal Sodium, and the sphincter is dilated gently. A hook is inserted into the depth of the crypt and pulled toward the anal margin. The mucosa is split along the course of the probe to the anal margin. Superfluous mucosa is then excised. Each diseased crypt is treated that way. Postoperative wet dressings, irrigations and sitz baths are used to clear up the infection. Hypertrophied papillae are simply excised, and the wound is sutured with fine catgut. The postoperative care is the same as for infected crypts.

### ANAL FISSURE

#### GENERAL CONSIDERATIONS

Anal fissures are longitudinal rents of the cutaneous lining of the anal canal, characterized by pain during and after defecation. They are commonly associated with other lesions, especially hemorrhoids and skin tags. Fissures may be acute but have a great tendency to chronicity. They are more frequent in females than in males. At the Mayo Clinic 37 per cent occurred in men and 63 per cent in women. The usual site of the fissure is the posterior anal wall; this is due to the fact that it receives more of the impact of defecation

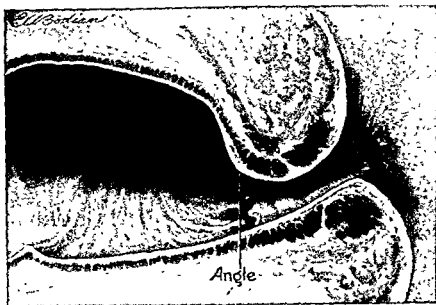


FIG. 140. Anorectal angle in male.

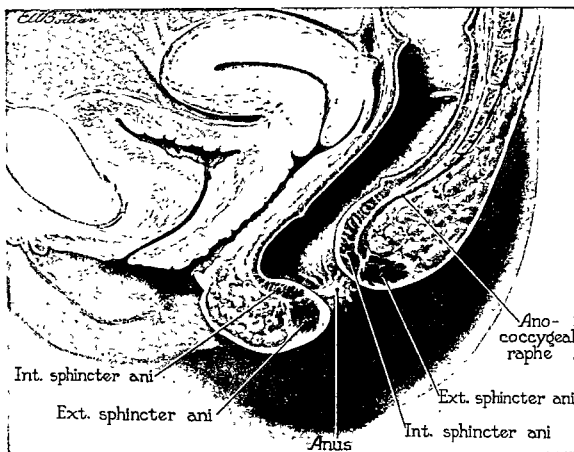


FIG. 141. Sagittal section of rectum of parous female. Note the rectal wall bulging anteriorly.

because the rectal and the anal walls meet at approximately a right angle (Fig. 140). This is true in the male and to a slightly lesser degree in the nulliparous female. After childbirth, however, when the rectovaginal wall is weakened, there is a variable degree of bulging of the anterior rectal wall into the vagina. With a well-developed rectocele it may be necessary for the woman to make pressure on the posterior vaginal wall in order to empty the rectum. As a result of bulging of the anterior rectal wall, an angle is formed anteriorly in parous women, and the impact of defecation in such women is more anterior than posterior (Fig. 141). Hence, one might expect fissures to occur anteriorly in parous women. Indeed, this is true, for at the Mayo Clinic only 0.4 per cent of the cases of anterior fissure were found in males.

#### SYMPTOMS AND DIAGNOSIS

No lesion in the gastrointestinal tract of such diminutive size gives rise to such acute distress. The characteristic symptom is pain during and/or following defecation. The pain may be constant and only aggravated by defecation. A small amount of bright blood is commonly noted on the stool or the toilet tissue. The symptoms may disappear for a time when the fissure heals, but recurrence is the rule.

The diagnosis usually can be made with near certainty by the history. To confirm the impression, the patient is placed on the examining table in the Sims position, and the anus is inspected as she strains. Unless the fissure is hidden by hemorrhoids or edematous mucosa, it usually can be seen easily. A skin tag, the "sentinel pile," is

almost always present just below the fissure. On digital examination, sphincter spasm is usually noted. At times such spasm is present as to prevent the introduction of the finger. Pressure against the fissure is extremely painful, and to palpate the anus successfully the nontender part should be first palpated with the finger well lubricated. Tenderness may be so extreme as to require general anesthesia for a satisfactory examination. When such tenderness is present, one can be sufficiently certain of the diagnosis to plan to do the necessary surgery at the time of examination under anesthesia.

### TREATMENT

Chronic fissures seldom heal permanently without at least division of the anal sphincter. It is our custom to anesthetize the patient with Pentothal Sodium. This anesthetic is particularly favorable for rectal operations because loss of sphincter tone is usually rather marked without exceptionally deep anesthesia. The sphincter is dilated slowly, digitally. This dilatation should take about 5 minutes in order to prevent deep lacerations; however, superficial mucosal rents are common. When sufficiently dilated, the anus should remain open, and the rectal mucosa will have a tendency to prolapse. Such dilatation will cure the average fissure, but since most fissures are associated with sentinel piles, it is our custom to excise the bases of the fistulas, together with the sentinel piles and the hypertrophied papillae if present. Cutting of the external sphincter fibers to some degree may be beneficial and, if the base of the ulcer is indurated markedly, one should not hesitate to excise this scar tissue deeply, even though the incision goes well into the sphincter. Usually, bleeding can be controlled by holding a gauze sponge against the wound for a few minutes. Occasionally, an arteriole or two may require ligation, but the wound is not sutured. Petrolatum gauze is placed against the wound. On the 2nd day the patient is placed on an ounce of mineral oil night and morning, and a saline cathartic is given on the morning of the 3rd day, if necessary. Sitz baths are started on the day following operation, and usually healing is remarkably prompt.

## ABSCESSSES AND FISTULAS

### GENERAL CONSIDERATIONS

Abscesses and fistulas are so closely related that it is impossible to consider them separately. It is the usual teaching that abscess precedes fistula, but Buie objects to this, for he believes that the reverse is true. As a matter of fact, the first thing noted clinically in most of the cases is the evidence of abscess formation. Following the rupture or surgical opening of the abscess, a fistula forms. Then, from time to time, if drainage from the abscess is poor, as is usually the case, abscesses recur, and the fistula persists between the appearance of a succession of abscesses. Distinction should be made between ischio-anal abscesses which form below the levator muscles and perirectal abscesses which form above the levator muscles in the pelvirectal spaces or in the retrorectal space. In a similar manner a distinction is made between anal and rectal fistulas, the internal opening of the former being below the pectinate line and of the latter above that level. Since some fistulas open internally directly at the pectinate line, they are properly called by some authors anorectal fistulas.

To consider the etiology of fistulas, one must first consider the etiology of abscesses. *Escherichia coli* is usually the predominating organism, but it is rarely found in pure culture, the enterococci frequently being associated. The initial infection is in the anorectal mucosa, commonly in one of the crypts or papillae. With a break in the rectal mucosa or anal skin, organisms enter the tissues. Abscesses may complicate a thrombosed prolapsed internal hemorrhoid and/or a fissure in ano. Superficial abscesses may originate in folliculitis in the perianal region, and it is probable that some blind external fistulas originate in that manner.

Fistulas are generally classified as (1) incomplete internal, in which there is no opening in the perianal skin, (2) incomplete external, in which there is no opening in the bowel, and (3) complete, in which there is an opening both externally and internally (Fig. 142). Incomplete fistulas are, in reality, only sinuses, but usage justifies the term fistula. The great majority of fistulas are in-

ected only with the usual fecal flora, but a few are tuberculous. Formerly, the incidence of tuberculous fistulas was thought to be as high as 40 per cent, but the evidence upon which this estimate was made is not conclusive. Many individuals with active pulmonary tuberculosis have anal fistulas, but section of the tissue dissected from the fistulous tract usually fails to show microscopic evidence of tuberculosis. Yeomans believes that about 15 per cent of fistulas are tuberculous, but at the Mayo Clinic the number of cases with active or quiescent tuberculosis elsewhere in the body and proved to be tuberculosis in the fistulous tract amounted to only 0.7 per cent of all the fistulas.

### DIAGNOSIS

With abscess there is a history of local pain, fever and great prostration. Usually, the diagnosis of ischio-anal abscess is made easily by inspection and palpation. Perianal swelling, redness and induration or fluctuation are obvious if the abscess has become

sufficiently superficial. Digital examination is very painful and reveals a perianal indurated or fluctuant swelling. The anal skin and the rectal mucosa are usually thickened by edema. When there is a high pelvirectal or retrorectal abscess, nothing abnormal is visible externally, and the diagnosis can be made only by feeling a tender fluctuant swelling through the rectal wall. Proctoscopic or anoscopic examination should be attempted only under anesthesia. The edematous mucosa may be stretched tightly over a fluctuating area or thrown into coarse folds over the inflamed perirectal tissue.

The diagnosis of fistula is usually quite simple. A history of an abscess that has ruptured or has been opened is the rule. If, in such an individual, a discharging sinus is seen in the perianal skin, the diagnosis is obvious. With the "sprinkling pot" type of fistula several external openings are present. Usually, a small papilla of granulation tissue is visible at the external opening, or there may be a depressed retracted indurated scar at the site

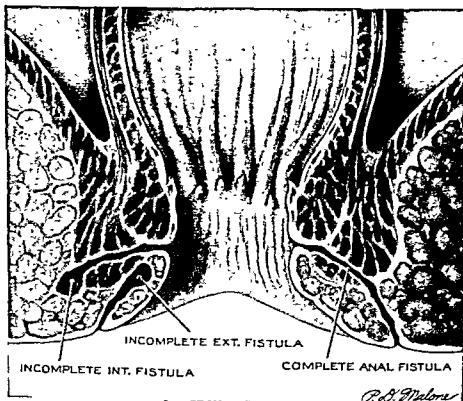


FIG. 142. Schematic illustration demonstrating three types of fistulas.

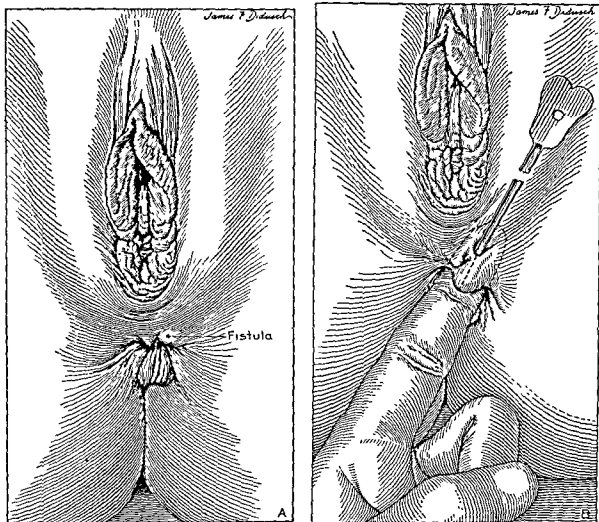


FIG. 143. Operation for anal fistula. (A) Showing location of external opening of fistula. (B) A grooved director has been introduced into fistula, which opens into the rectum between sphincters.

of rupture or previous incision. On introducing a finger into the rectum, a cordlike indurated tract can be felt running from the external opening to the anus or the rectum. Often the internal opening can be located as an irregularity, such as a depressed pit or elevation resulting from scar tissue. The most common site of this lies between the two sphincters. Sometimes a small probe can be passed from the external opening into the bowel with the greatest of ease. If the tract is at all complex, this cannot be accomplished and should not be persisted in with the unanesthetized patient. However, one never should conclude that there is no internal opening simply because one is unable to prove its presence readily by probing. Injec-

tion of the external opening with a small glass-tipped syringe filled with methylene blue solution or, better still, hydrogen peroxide stained with methylene blue usually proves the presence of an internal opening. An applicator wound with cotton is introduced into the rectum. The nose of the syringe is held tightly into the external opening and steady pressure on the bulb is maintained for a few minutes. If a great amount of the colored solution enters the rectum, it usually appears at the anal orifice. If only a small amount enters the bowel, it at least stains the cotton swab. A Sims speculum may be introduced into the rectum and moved about as one searches for the point of escape of the methylene-blue solution.



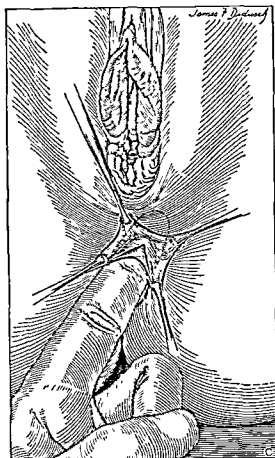


FIG. 143 (Continued). Operation for anal fistula. (C) Incision has been made against a grooved director, cutting the external sphincter. Scar tissue about the fistulous tract is then excised, and the wound is packed with petrolatum gauze.

#### TREATMENT OF ANORECTAL ABSCESS

The patient is given a Pentothal Sodium anesthetic and is placed in the lithotomy position. Fortunately, most of these abscesses are of the ischio-anal type, that is, below the levator muscles. They usually point in the perianal region, and they should be permitted to point rather than be opened through a great thickness of tissue. If much tissue is cut through in order to reach the abscess cavity there is a greater likelihood of fistula formation. A cruciform incision is made, cutting away the corners to form a roughly circular opening to prevent closure. This ensures good drainage and minimizes the chances of fistula formation. The finger is inserted into the abscess cavity, and the trabeculae are broken down. The cavity is then packed with petrolatum gauze, which is held in place by a flat gauze dressing. The packing is removed on the 4th day, and the cavity is irrigated with potassium permanganate solution, 1-5,000. Sitz baths, 3 times a day, are begun immediately. The cavity is not repacked, for if sufficient skin has been excised, it will not close prematurely. It is a good plan to insert a sterile gloved finger at intervals of a few days to prevent pocketing. An ounce of mineral oil is given morning and night, beginning the day after operation, and a laxative is administered on the 3rd night. The patient is instructed to take a sitz bath after each defecation in addition to the regularly scheduled baths. The sitz baths continue until the wound is healed.

Pelviorectal abscesses or retrorectal abscesses may burrow downward and point in the perianal region. Then they should be opened as an ischio-anal abscess, the finger inserted, and an attempt made to dilate the communication with the supralelevator abscess cavity so that the upper cavity also may be drained. When such abscesses point as soft cystic masses through the rectal wall they should be opened with a longitudinal incision through the rectal wall. In women the abscess may be found by rectovaginal examination to involve the rectovaginal septum. In such cases the rectal mucosa is incised rather than the vaginal mucosa, thus avoiding the possibility of a rectovaginal fistula. Following the intrarectal opening of an abscess the bowels should be kept open and the stools

With a blind internal fistula, often the opening can be felt and a bent probe introduced into the sinus tract as the opening is exposed either by retraction of the buttocks or through a speculum. One should be guarded in making a diagnosis of a blind external fistula on one's inability to locate an opening into the bowel lumen. The opening may be small, temporarily closed or the tract so tortuous and fine that even the colored solution may not enter the bowel. Failure to find an opening into the internal opening often results in failure to cure a complete fistula which was taken to be of the blind external type.

soft. Following each defecation an irrigation of the rectum with warm saline solution cleanses the abscess cavity and promotes healing.

#### TREATMENT OF ANORECTAL FISTULAS

The treatment of anal and rectal fistulas is surgical. The possibility of cure by any other method is so slight that it is not worthy of consideration. Simple fistulas, such as the one shown in Figure 143 A are easily curable by introducing a grooved director through the external opening into the anal canal (Fig. 143 B) and incising into the fistulous tract. Such a fistula usually ends in an anal crypt, and often there is a hypertrophied papilla. The enlarged papilla and the old inflammatory tissue surrounding it are excised (Fig. 143 C).

The margins of the wound are grasped with Allis clamps and retracted. A search is made for all possible communicating chan-

nels, which are opened if discovered. All of the pyogenic gelatinous and fibrous membrane lining every portion of the tract is excised (Fig. 144). The overhanging margins of the skin are cut away, and the wound is packed with sterile gauze. An occasional blood vessel must be sutured. Not infrequently, difficulty will be had in finding the internal opening, and the operator may conclude that he is dealing with a fistula of the blind external type when actually it is a complete fistula with a very small or temporarily closed internal opening. Sometimes a small internal opening can be located through an anoscope and a probe introduced from within outward. When the fistulous tract is particularly complicated it may be injected with methylene-blue solution from time to time during the operation and followed a short distance at a time with a flexible probe. At times the tract can be followed right up to the rectal mucosa, but no internal opening

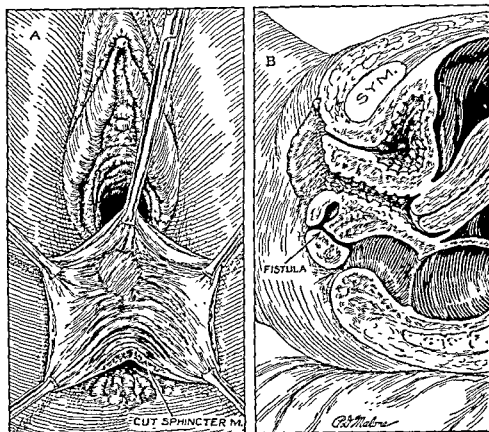


FIG. 144. Fistula with ramification in rectovaginal septum. (A) The external sphincter has been cut, and the entire tract laid open. The base of ramification is still visible. The entire lining of the tract is to be excised. (B) Sagittal view showing entire fistulous tract.

can be found. It is probable that a small opening exists close to this point which may be closed temporarily. It is extremely unlikely that a cure will be effected unless the bowel is opened. Hence, it is better to carry the incision through as much sphincter as necessary and through the bowel wall to the point at which the probe approaches the mucosa. The multiple external openings of the "watering pot" type of fistula must all be opened, and often an area of skin from the buttock must be excised. In opening up the multiple fistulous tracts often 2 metal sounds can be used to advantage, feeling for a clicking sensation as the sounds touch.

There are several reasons for failure to cure anorectal fistulas. Failure to find and open all the ramifications is one of the commonest causes of failure to cure complex fistulas. Removing too little tissue from the external part of the wound, so that a flap of tissue heals over and prevents good drainage, may result in a recurrent fistula. Allowing the pack to remain in for a week or more may fix the sphincter ends in scar tissue, and they may fail to heal together sufficiently well to function. Rarely, tuberculosis is the cause of failure.

The question of cutting the sphincter often disturbs the surgeon. The necessity of cutting both the external and the internal sphincter causes one to worry about the possibility of incontinence. We have considered it to be absolutely essential to effect a cure in some cases, and to our knowledge none of the patients has been left with sufficient sphincter incompetence to be serious. In rare instances the sphincter has been left too weak for complete control with diarrhea. If complete severing of both sphincters is necessary, it is desirable, if possible, to make the incision in the mid-line posteriorly where the arrangement of the external fibers is parallel, so that incision separates rather than severs the fibers. However, it is rarely necessary to cut both sphincters, as most fistulas open between the external and the internal sphincters.

## BENIGN ANORECTAL STRICTURE

### ETIOLOGY

Anorectal strictures fall into 2 groups morphologically.

Ring strictures are characterized as circular diaphragmatic structures in the lower portion of the rectum or the anal canal. They are almost always the result of previous operation for hemorrhoids. The now-almost-obscure Whitehead operation contributed more than its share of postoperative strictures. However, they can occur after properly performed extensive radial excision of hemorrhoids, as described in this chapter, if proper postoperative treatment is neglected and the operative site is permitted to heal with the sphincters contracted.

Tubular strictures are the result of inflammatory disease, in which a segment of the rectum is converted into a rigid contracted tube with marked diminution of the lumen. The cause of most inflammatory strictures of the rectum is now thought to be lymphopathia venereum, a disease believed to be due to a filtrable virus. Until this disease was described, most proctologists were willing to accept syphilis as the cause of inflammatory rectal strictures. The percentage of positive serologic tests for syphilis was high, but there were many cases with negative tests. Yeomans reports 86 per cent to have positive Wassermann reactions. On our colored service a high percentage of the cases with tubular stricture have positive tests for syphilis, too high to be an incidental finding. Hence, it is probable that a certain percentage of these strictures is syphilitic, but the exact percentage cannot be given with scientific accuracy. Tubular inflammatory strictures are commonly seen on our service in colored women who have ulcerative and hypertrophic changes in the vulva and the vagina, representing the typical picture of lymphopathia venereum. It seems almost certain that the rectal lesion is of the same etiology as the genital one. It has been shown that there is a direct connection between the lymphatics of the genital tract and the rectum through the uterosacral ligaments, so that the virus of the primary lesion on the cervix or the vagina could easily be transported to the rectal and the perirectal regions. Infection and lymphostasis result in fibrous and ulcerative changes in the rectal wall which ultimately contract and produce stricture.

Stricture of the rectum from extraneous gynecologic conditions is encountered occa-

sionally on a gynecologic service. Pressure from large fibroids incarcerated in the pelvis may encroach on the bowel lumen. Extensive pelvic inflammatory disease when the whole pelvis is frozen in a mass of cellulitis leaves little room for the bowel wall to find space to tunnel through. Such an inflammatory process also extends to the rectal wall itself, and edema and fibrosis further encroach on the lumen. Such an inflammatory process in the bowel wall always clears up after removing the inflamed pelvic organs and does not result in permanent rectal stricture. One also encounters cases of extensive carcinoma of the cervix in which the rectal wall is involved and partially occluded. Irradiation for uterine carcinoma may result in stricture of the rectum, but in our experience the sigmoid is more often affected.

#### SYMPTOMS AND DIAGNOSIS

The symptoms of rectal stricture are most distressing. There is usually a history of progressive constipation, but many of the victims complain of diarrhea. By this is meant an almost constant desire to defecate with the passage of pus, blood and sometimes small amounts of stool. The stools are small in caliber and often must be kept liquid by the use of cathartics if they are to occur. Pain at the rectum, especially at defecation, is a usual complaint, and often abdominal cramps result from the accumulation of feces in the bowel above the stricture. With noninflammatory ring strictures, patients may remain in relatively good condition by the use of cathartics but, with inflammatory tubular strictures, the general health is usually undermined. There are loss of weight, chronic nausea and anemia as the result of toxemia and blood loss. The diagnosis is strongly suspected from the history and as a rule easily confirmed by rectal palpation. Most rectal strictures are low enough to be easily palpated digitally, but if the history is suggestive and none can be felt, the patient should be proctoscoped.

#### TREATMENT

Postoperative strictures can be prevented by proper postoperative care, provided that the proper type of operation has been done.

This is discussed in this chapter under the treatment of hemorrhoids. Usually these ring strictures can be treated quite successfully by dilatation. If sufficient dilatation cannot be attained by gentle efforts with the patient awake, she may be given an intravenous anesthetic and the dilatation carried out a little more forcefully. Because ring strictures are low, there is not the danger of peritonitis from splitting of the rectal wall that is present when higher strictures are dilated. However, perirectal abscesses can result from splitting low strictures; hence, the greatest of care must be exerted in dilatation. Since the amount of pressure required can be gauged more accurately by the finger than through an instrument, digital dilatation is preferred. When dilatation to the necessary caliber is impossible digitally, Buie suggests dilatation by means of proctoscopes of increasing sizes, since this is much safer than by the usual blind dilatation. Through the proctoscope, one can see the exact location of the lumen and where dilatation is required. After determining through the proctoscope where pressure is required, the obturator is inserted, and the proctoscope is passed through the contracted lumen. After dilatation, the bowel is irrigated with salt solution, and the patient is required to give herself irrigations after each defecation. Patients who require dilatation should not be lost sight of but should return from time to time to the physician for observation and dilatation, as necessary, before the stricture has completely contracted again.

Sometimes tubular strictures due to lymphopathia may be treated by dilatation with moderate success, but when the process is extensive, little can be accomplished. The force necessary to dilate the lumen is often greater than is compatible with safety. The operation of internal longitudinal proctotomy can be done sometimes if the stricture is below the peritoneal reflexion. The electro-surgical knife is an excellent instrument for this procedure. Such an operation should be followed by dilatations and irrigations. When the stricture is nearly complete, a temporary colostomy should be done to divert the feces while dilatation or some operative procedure is carried out on the rectum. When the rec-

tum is absolutely solidly fixed in a mass of lymphopathic diseased tissue, sometimes thickened fibrotic tissue can be carved from the posterior wall to increase the lumen. Occasionally, a Heineke-Mikulicz type of procedure can be done by making a longitudinal incision through the posterior rectal wall, pulling the upper part of the incision down and closing the incision transversely. The results with advanced lymphopathic stricture are not good with any type of operation. Operations must be followed by dilatation and irrigations. If all surgical efforts fail completely, a permanent colostomy may be required.

#### POSTIRRADIATION PROCTITIS OR "FACTITIAL DISEASE" OF THE RECTUM AND THE SIGMOID

This condition should be considered briefly in this chapter, although irradiation injuries to the intestinal tract are considered in the chapters on cervical cancer and the intestines in relation to gynecology. The term "factitial proctitis" was coined in 1930 and designates a pathologic phenomenon sometimes found in the rectum and the sigmoid after irradiation of the pelvic viscera. It most often occurs after irradiation for cervical cancer. The symptoms of the disease may occur within a week or after several months following irradiation. The most important problem has to do with a decision whether the bowel lesion represents an extension of the malignancy or the result of irradiation. The problem is quite comparable with that presented in the bladder following irradiation for cervical cancer.

Rectal bleeding is the most frequent symptom. It is often accompanied by a frequent desire to defecate with small discharges of blood, mucus and liquid fecal matter. In some patients there is severe tenesmus, and some degree of rectal pain is common. The patient

may complain of interference with evacuation due to stricture formation.

Proctoscopic examination reveals hyperemia and often ulceration, chiefly of the anterior rectal wall. The lower, middle or upper portion of the rectosigmoid may be involved or the entire area. The mucosa is often fiery red and edematous, and the rectum is extremely sensitive to the proctoscope. In the older lesions when healing has taken place telangiectasis is common. Later, the scarred areas may be of pale yellow. The involved area oozes freely when touched with the proctoscope. Not infrequently, strictures develop. Biopsy of the bowel wall should be done to make certain there is not an extension of the original malignancy.

The treatment first of all is to assure the patient, if possible, that the rectal condition does not represent an extension of the primary malignancy. She should also be told that the complete recovery from symptoms may require a long time. If the patient's condition is debilitated, she should be hospitalized and her electrolytic balance restored. If anemia is present, it should be treated medically and/or by transfusion. A bland low residue diet should be given. Warm soothing rectal irrigations may be used after each bowel movement, which often greatly reduce the patient's discomfort. A warm oil retention enema at bedtime is also soothing. In rare very severe cases which fail to yield to medical therapy a temporary diversion of the feces by colostomy may be necessary. This is particularly the case when there is marked stricture formation.

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# Myomata Uteri

## GENERAL CONSIDERATIONS

Myomata uteri are the commonest tumors of the uterus, and the commonest of the female pelvis. It is impossible to determine with accuracy the incidence of fibroids in women. The incidence, frequently quoted, of 1 in 5 found at postmortem examinations seems to be too small on the basis of the author's experience. Certainly in the colored race the incidence is much greater than that. Fibroids occur chiefly during the latter half of the menstrual life, but their occurrence earlier is not uncommon. In the colored race they are commonly seen before 30. Their growth is dependent upon estrogen, and after the cessation of estrogen secretion at the menopause atrophy is the almost invariable rule. In rare instances a benign fibroid grows after the menopause. When this occurs, one thinks of the possibility of postmenopausal estrogen formation, either in the ovary or elsewhere. In two such instances the author has found lutein-like cells distributed through the postmenopausal ovarian stroma, suggesting that the estrogen had been formed there. Further evidence of the relation of estrogen to fibroid growth is the fact that small fibroids have been produced artificially on the serous surfaces of the uteri of guinea pigs by estrogen injections.

The proper treatment of fibroids is not as simple as one might judge when one sees a constant succession of hysterectomies for fibroids in almost any gynecologic operating room. In order to treat fibroids properly, their growth characteristics should be known to the surgeon. They may occur singly, but the vast majority are multiple. They arise in the fibromuscular tissue of the myometrium, and histologically they are fibromyomata. There is great variation in the relative amount of fibrous and muscular tissue, but

on the whole smooth muscle exceeds fibrous tissue. Since they arise in the myometrium they are all, at the onset, interstitial. As they enlarge they may remain interstitial, but often the growth extends internally or externally, becoming submucous or subserous. In either position they may become pedunculated. The subserous tumors not infrequently become adherent to other structures, especially the omentum. They then obtain some of their blood supply from the omentum and in some cases all of it, as the uterine pedicle disappears completely.

The typical fibroid uterus is a firm multinodular structure of variable size. The largest observed by the author was 40 pounds, but much larger ones have been reported. Tumors of from 8 to 10 pounds are not rare, especially on the colored service, but in private practice they are usually much smaller. At the operating table they appear as nodular tumors of different sizes which distort the uterus in various ways, depending upon their size and direction of growth. Growth between the leaves of the broad ligament may make surgical removal difficult.

It is an excellent practice to have an assistant open the uterine cavity of all myomatous uteri in the operating room directly after their removal. The endometrium should be inspected in search for incidental endometrial cancer. In addition to opening the uterine cavity, the larger fibroid nodules should be cut into. In order to interpret the findings at such an examination, the surgeon should be familiar with the various gross changes that take place in fibroids. The normal fibroid, on section, appears pinkish white and glistening. It is firm, and there is a whorl-like arrangement of the muscle and the fibrous tissue. The commonest change is hyaline degeneration. The cut surface of a hyalinized

area is smooth and homogeneous and does not show the whorl-like arrangement of the rest of the fibroid. Almost all fibroids, except the smallest, have scattered areas of hyaline degeneration. Eventually, these may become liquefied and form cystic cavities filled with clear liquid or gelatinous material. Sometimes the cystic change is so great that the fibroid becomes a mere shell and is a truly cystic tumor. When such tumors cause symmetrical enlargement of the uterus they may be taken for a pregnant uterus on bimanual examination; when subserous and pedunculated, they may easily be confused with ovarian cysts. However, softness of a tumor does not necessarily indicate cystic degeneration. Fleishy myomata may be equally soft.

Fibroids may undergo changes due to infection, and on the colored wards where salpingitis commonly complicates fibroids, an extension of the infection into the tumor from without is common. Microscopic abscesses are frequently found, and gross abscesses occasionally occur in the tumors. In addition to this route of infection, submucous fibroids may become infected within the uterine cavity or the vagina. The pedunculated submucous fibroid thins out the endometrium as it grows downward, and eventually the surface becomes ulcerated and infected. This is invariably true if the fibroid descends as low as the cervical canal. Such infections are usually due to the streptococcus and may be very virulent. Parametritis, peritonitis and even septicemia may result.

Necrosis of a fibroid results from interference with the blood supply. Occasionally, a pedunculated subserous fibroid twists and, if operation is not done immediately, gangrene results. Interference with the blood supply of a tumor may also occur as a result of thrombosis of the blood vessels due to infection. Such thromboses are seen commonly in the pedicle of a necrotic submucous fibroid. Necrosis sometimes occurs in the center of a large tumor simply as a result of poor circulation. Necrotic fibroids are dark and hemorrhagic in the interior; eventually, the tissue breaks down completely. So-called red or carneous degeneration is seen occasionally, especially associated with pregnancy. The cause is unknown, but thromboses and

extravasation of blood are responsible for the reddish discoloration.

On rare occasions fat occurs in fibroids as true fatty degeneration, to the extent of giving the cut surface a yellowish discoloration. Still more rarely is there a deposit of true fat forming a fibrolipoma.

Finally, the most important change, sarcomatous degeneration, should be considered. Fortunately, it is rare. There is much variation in the reported incidence of sarcoma occurring in myomata. The incidence given by Evans of the Mayo Clinic is 0.7 per cent. Vogt reports an incidence of 0.46 per cent in 72,000 cases found in the literature. Novak and Anderson found it in 0.56 per cent in our laboratory. Corscaden and Singh found the incidence of *lethal* sarcomatous change in fibroids to be 0.13 per cent or 1 in 800 cases. In the literature, however, a reported incidence up to 4 per cent can be found. The reason for the disparity in the statistics is understandable if one is familiar with the histology of fibroids. Very cellular fibroids are relatively common, and at first glance they suggest sarcoma; however, they lack mitotic figures, and patients from whom such tumors are removed all remain well. The misinterpretation of the histologic picture of this type of cellular fibroid undoubtedly accounts for the increased incidence reported by some. On cutting fibroids in the operating room, sarcomatous areas have a characteristic appearance. Sarcoma is apt to occur in rather large fibroids and toward the center of the tumors where the blood supply is poorest. Instead of the firm fibrous tissue which grates when scraped with a knife blade, the tissue is soft and homogeneous. Cullen has described it as simulating raw pork. Later, there is a necrosis of the malignant tissue, and it becomes friable and hemorrhagic.

The possibility of malignancy is, as indicated above, small. However, the consequences resulting from incomplete pelvic surgery when sarcoma is present are so serious that routine cutting of the tumor in the operating room is worth while. Novak and Anderson clearly demonstrated that radical surgery is the backbone of successful treatment. They found that 30 per cent of their

traced cases were well 5 years after the operation; Kimbrough found 34 per cent of his series of patients were well after 5 years.

### ASYMPTOMATIC MYOMATA

Before considering the symptoms that demand treatment of the fibroids, it might be well to regard the large group of fibroids that give no symptoms. Asymptomatic fibroids are encountered much more frequently than tumors which do give rise to symptoms. Untold numbers of such symptomless fibroids have been removed surgically which would have been better left undisturbed. One always should bear in mind that the incidence of malignancy is less than 1 per cent; and in small tumors it is far less than that. This incidence is less than the mortality rate of hysterectomy in the average hospital, so unless there is some special reason to suspect malignancy the danger of the operation exceeds the danger of malignancy. A history of rapid growth, or especially postmenopausal growth, calls for removal even though the tumor is giving no symptoms.

Small tumors that are quite symptomless need only be observed from time to time. It is remarkable how stationary in size such tumors may remain for years. If such small fibroids are discovered late in menstrual life, it is unusual for treatment to be required. Larger tumors may also be watched safely, but if a policy of watchful waiting is adopted one should be very sure of the nature of the tumors. If there is uncertainty of the uterine or ovarian origin of a tumor, as may well be the case when the tumor fills the whole pelvis or when a pedunculated tumor is felt in the adnexal region, the uncertainty can usually be cleared up by an examination under anesthesia. If still in doubt, culdoscopy may be of great value in making the differentiation provided that the cul-de-sac is not blocked by tumor. If uncertainty still exists, a laparotomy should be done.

When asymptomatic fibroids are discovered in young women, the problem of the relation of such tumors to sterility and pregnancy usually arises. With the increase in sterility work that has appeared during recent years, a growing number of asymptomatic fibroids has been discovered in young women.

The finding of small fibroids in sterile women is not an indication for immediate myomectomy. Both marital partners should be completely investigated for sterility, and the fibroids should be disregarded for at least a while. The ultimate disposal of the fibroids depends on their nature. Usually, small subserous fibroids cannot reasonably be considered a factor in the sterility; even though the woman fails to become pregnant, removal of the fibroids is not justified. When fibroids are intramural and of fair size or submucous, they may well be factors in the sterility, and a myomectomy may be rewarded with a subsequent pregnancy.

The finding of asymptomatic fibroids in women who expect to undergo pregnancy often presents a problem requiring the best of obstetric and gynecologic judgment. Many small subserous and intramural fibroids do not influence the course of pregnancy in the least; nor does the pregnancy influence the fibroids in many instances. On the other hand, intramural and, to a greater degree, submucous fibroids of fair size undoubtedly increase the incidence of abortions and complicate the abortions when they occur. Pedunculated subserous fibroids are more prone to twist during pregnancy; fibroids of reasonable size may become painful in the course of pregnancy, due to pressure and degeneration; finally, large fibroids low in the pelvis may obstruct the birth canal and make vaginal delivery impossible. The finding of totally unsuspected, asymptomatic fibroids in a young woman who contemplates pregnancy is usually very much of a shock to her. The greatest tact is required in presenting the problem to the patient, and the best of surgical and obstetric judgment is needed to arrive at the right solution. Should she be allowed to attempt the pregnancy with a realization that her chances of complications are greater than in the normal woman? Should a myomectomy be advised before pregnancy is attempted, running the risk of being forced to perform a hysterectomy when attempting the myomectomy? Should she be permitted to become pregnant, go to term and then have a cesarean section, leaving the fibroid uterus with the hope of more pregnancies? Should she go to term and have a



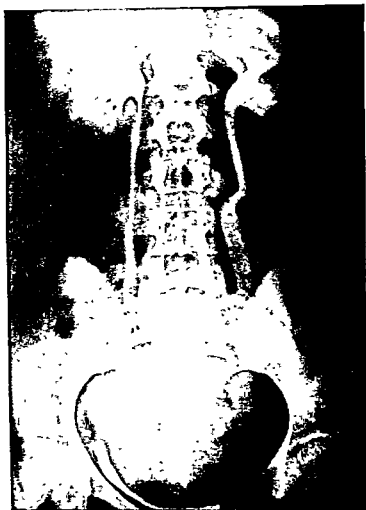


FIG. 145. (*Left*) Showing unilateral ureteral dilatation and distortion of bladder from pressure of large fibroids. (*Right*) Unilateral hydronephrosis resulting from pressure of large myoma.

cesarean section and hysterectomy at term? These, and others, are problems that one must attempt to answer. Such questions cannot be answered by any rule. Each case presents its own problem, and the answer is not entirely dependent upon the physical condition of the pelvis. The patient's age, her general physical condition and, not the least, her mental attitude must all be considered before a final decision is made.

When large asymptomatic fibroids occur in young women who have had their families or in whom childbearing is not important, they should be removed. Such tumors, with perhaps 15 or 20 years to grow before the menopause, are bound to require surgical removal eventually; hence, it is better to remove them when the patient is relatively young and a good operative risk.

In women approaching the menopause relatively large fibroids are often safely kept under observation, with the hope that after the menopause they will regress. While observing fibroids of this type in recent years we have made it a rule to make intravenous urograms. Everett and Sturgis have shown that not uncommonly there is evidence of pressure at the pelvic brim, so that hydronephroses and hydronephroses develop (Fig. 145). Although at times this back pressure results in pain, the process is often quite painless, even when serious damage is done to the kidneys. Evidence of kidney damage seen in the pyelogram may be the deciding factor in making up one's mind to operate on a patient with an entirely asymptomatic fibroid. Furthermore, the incidence of hypertension was found by Everett and Scott to be

more than twice as great among those patients who showed x-ray evidence of urinary tract stasis. It was suggested by the authors that this hypertension might be the cause of "myoma heart" about which there was so much discussion in years past.

After the menopause, asymptomatic fibroids generally should be left undisturbed. Here again the surgeon must be absolutely certain that he is not dealing with a solid ovarian growth. The appearance of even a little vaginal bleeding should make one suspect cervical malignancy, endometrial malignancy or sarcomatous change in the myoma. Curettage and cervical biopsy should be done; if the bleeding is not explained by

these procedures, the fibroid uterus should be removed because of the danger of sarcomatous change.

### SIGNS AND SYMPTOMS INDICATING TREATMENT

Bleeding is the commonest symptom that indicates the necessity of treatment. The mechanism by which fibroids cause bleeding is not clear in every instance. The pedunculated submucous fibroid (Fig. 146) bleeds freely at menstruation as a result of passive congestion, necrosis and ulceration. With these changes there is usually a constant thin blood-tinged discharge, in addition to the menorrhagia. The intramural tumor, which

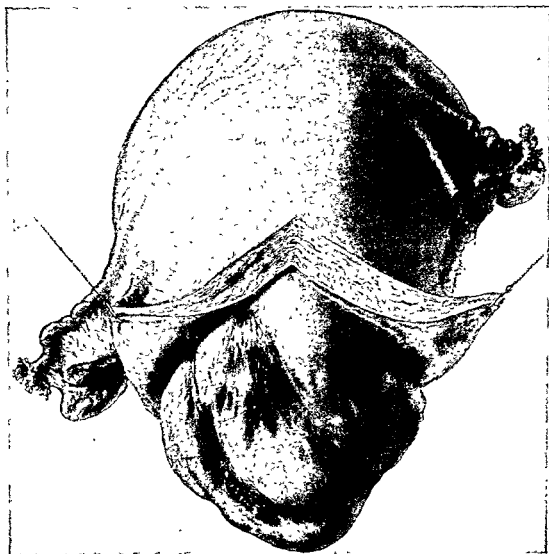


FIG. 146. Pedunculated submucous myoma showing necrosis and ulceration.

is just beginning to encroach on the endometrial cavity, can be responsible for menorrhagia by virtue of its pressure on the veins formed by confluence of the endometrial capillaries. Large tumors may greatly increase the size of the uterine cavity and thus give rise to menorrhagia simply because there is an increased bleeding surface. The intramural fibroids near the serosal surface and pedunculated subserous tumors cannot be considered responsible for bleeding; when bleeding occurs with such tumors one should search for some other lesion to account for it. Indeed, one always should bear in mind that the mere presence of fibroids in a bleeding woman is not proof that the fibroid causes the bleeding, for the fibroids may be incidental and the bleeding due to some unrelated lesion. This fact is particularly to be stressed when there is intermenstrual bleeding. It is a rule on our service to curette and to perform a cervical biopsy on all women with fibroids in whom there is intermenstrual bleeding, before proceeding with the treatment of the fibroid.

When bleeding occurs postmenopausally and fibroids are discovered on bimanual examination the question arises whether or not the fibroid is responsible for the bleeding. The answer is usually in the negative. In

more than half of such instances the bleeding is due to some other lesion such as cervical or endometrial malignancy, and the fibroids are purely incidental. The next question that naturally occurs is whether or not the postmenopausal fibroid *can* be responsible for the bleeding. The answer to that question is in the affirmative. Fibroids that did not bleed during the menstrual life of the patient have been found to migrate to a submucous position after the menopause, become ulcerated and bleed. Also, we have very rarely observed growth in a fibroid postmenopausally and have found no malignancy in the tumor. However, whenever there is evidence of growth in a fibroid after the menopause, one should consider seriously the possibility of malignant change and treat the patient accordingly. If, in addition, there is bleeding the chances of malignancy are very high.

Evidence of pressure on near-by pelvic viscera is also an indication for treatment. The urinary bladder is the organ that suffers most often from such pressure, giving rise to frequency of urination (Fig. 147). Although this symptom is common with large fibroids, it is remarkable how frequently one sees the pelvis filled with fibroids without any increased frequency of urination. The great ability of the bladder to function normally in spite of extreme distortion by pelvic tumors is truly remarkable. Occasionally, acute retention of urine results from a fibroid and necessitates surgical interference. We have seen this occur as the result of marked growth of the fibroid anteriorly, pressing the superior surface of the bladder against the internal sphincter region. More frequently a tumor of about the size of a 3-months' pregnancy incarcerated in the cul-de-sac pushes the cervix downward and forward and obstructs the flow from the urethra. We have also observed a large pedunculated submucous tumor, filling and distending the vagina, pressing on the urethra and causing retention. As stated previously, the pressure of the tumor upon the ureters at the pelvic brim, with resultant kidney damage, may indicate the necessity of operative treatment.

The bowel is less apt to show symptoms from pressure than the bladder, but constipation can be caused and aggravated by such



FIG. 147. Cystogram, showing distortion of the bladder by pressure from a fibroid.

pressure; more frequently, one is astounded by the relatively normal function of the bowel in the presence of large fibroids that almost completely fill the pelvis. Very rarely, we have seen acute intestinal obstruction occur from pressure of a large fibroid on the bowel.

Occasionally, treatment is indicated because of edema of the lower extremities caused by pressure of the fibroid on the iliac veins. As a rule, however, even large fibroids cause surprisingly little lower extremity edema; when the edema is great it is well to think of the possibility of an infiltrating malignant pelvic tumor occluding pelvic veins and/or lymphatics, or to consider cardiac or renal disease.

Abdominal or pelvic pain is a frequent reason for operative interference. There are many causes for pain with fibroids; the pressure of a large but uncomplicated tumor on the pelvic nerves may give rise to pain, and tumors which are the site of extensive necrosis are also sometimes painful. In rare instances pedunculated fibroids twist and give rise to a clinical picture of acute abdominal pain much like one sees with a twisted ovarian tumor. In the author's experience fibroids twist on their pedicle more often postmenopausally and during pregnancy. The commonest cause for pain in our public ward experience is a complicating pelvic inflammatory disease, acute or chronic. A long-standing pelvic inflammatory residue that has been asymptomatic for months or years may become painful when the growing fibroid begins to stretch the pelvic adhesions. Circulatory disturbances and edema resulting from pressure of the tumor upon chronically infected tubes sometimes results in acute or subacute painful exacerbations. Such pelvic inflammatory disease seldom responds well to palliation, and surgery is necessary soon or late. Dysmenorrhea, acquired in the 4th or the 5th decade, may be the outstanding symptom of the growth of fibroids. A common symptom complex resulting from fibroids at this time of life is menstrual pain, coupled with increased menstrual flow. Diffuse adenomyosis may also cause these symptoms, and the differentiation of this condition from a symmetrically developed intramural fibroid may be extremely difficult. The differentiation is chiefly academic, for in either case surgery

is indicated if the symptoms are of sufficient severity.

**Distortion of the abdomen** due to large tumors may justify their removal. Tumors of such size frequently give rise to other symptoms also, so that there is ample reason for surgical interference, but when no other symptom is present one is justified in removing the tumors if the abdominal distortion is of such proportions as to be distasteful to the woman. Occasionally, ascites forms with benign fibroids as a result of pressure on the veins, but when it is discovered there is always a likelihood of malignancy in the fibroid or an accompanying ovarian malignancy, and operation should not be deferred.

**Rapid Growth.** Evidence of rapid growth of a fibroid is an indication for surgical interference. It may suggest malignancy in the premenopausal fibroid, but this is not usually the case. In the postmenopausal fibroid, however, growth almost always indicates malignancy. Although this is not an invariable rule, the chances are so great in favor of malignancy that one must proceed on that assumption and resort to immediate removal.

**Sterility.** Fibroids are not infrequently the cause of sterility, especially in late marriages; pregnancy following myomectomy is often observed. On the other hand, pregnancy occurs innumerable times in myomatous uteri, and we who have a large proportion of colored patients in our clinic are often astounded at the presence of pregnancy in uteri containing huge multiple fibroids. The best obstetric judgment is often needed to decide whether pregnancy should be attempted before surgery is done on the fibroids. Clinical experience teaches us that many times fibroids are responsible for repeated abortions or premature babies, and yet one is frequently surprised at the smooth course of pregnancy in the presence of even large tumors. Due to increased blood supply and hormonal action, fibroids may grow rapidly during pregnancy. On the other hand, they may become very soft and apparently disappear; they usually again become firm and palpable after involution of the uterus. Pressure of the growing fetus may interfere with the blood supply of the tumor formed in the pelvis, causing painful necrosis and giving rise to tenderness suggesting peritoneal

irritation. These complications during pregnancy may call for surgical relief without delay.

### CHOICE OF TREATMENT

Fibroids are successfully treated surgically and with irradiation. Both methods have their advantages and disadvantages; both have their indications and contraindications.

#### SURGICAL TREATMENT

Surgery has many advantages over irradiation, and the mortality of hysterectomy for fibroids in the better clinics is very low. We operate on many times as many patients for fibroids as we treat by irradiation, chiefly because surgery offers a flexibility of treatment that is not possible with radium. We refer particularly to the possibility of myomectomy, conservation of one or both ovaries, removal of diseased tubes and the removal of the chronically infected cervix. It also permits corrective plastic surgery which is often indicated in women of the myoma age. In this group of patients vaginal hysterectomy is often the operation of choice. Although we do not advocate removal of very large tumors by morcellation by the vaginal route, vaginal hysterectomy is an extremely useful procedure when dealing with small fibroids. The advantages and the contraindications for vaginal hysterectomy in relation to fibroids are discussed later in this chapter. The advantages of surgery over irradiation are reflected in the contraindications to irradiation that follow.

Since the removal of myomata is the most frequent indication for hysterectomy, the discussion of total versus subtotal hysterectomy is included in this chapter. The techniques of total abdominal and subtotal abdominal hysterectomy are also included, as well as a discussion of the question of myomectomy. The techniques of abdominal and vaginal myomectomy are also described and illustrated.

#### IRRADIATION TREATMENT

In our clinic irradiation is reserved for those fibroids requiring treatment in which the patient's general condition contraindicates surgery and for small bleeding fibroids occurring in women near the menopause, provided that these bleeding fibroids are not of

the pedunculated submucous variety. However, not all of such small bleeding fibroids are irradiated. If the patient is a very nervous woman for whom the artificial menopause would almost certainly be a serious ordeal, we prefer surgery with preservation of ovarian function. It is our clinical impression that the symptoms of the radium menopause are, in general, more severe than those of the natural menopause. There is also an occasional patient who has a fibroid which should be removed surgically, but she steadfastly refuses operation. Such tumors are irradiated as the second best method of treatment. In all patients who are irradiated, preliminary curettage and cervical biopsy are done.

If the patient lives in the city where x-ray equipment is available we are inclined to treat her with x-rays rather than radium. X-ray treatment has the advantage of not requiring hospitalization, but it is more time-consuming. If the patient lives out of the city, we admit her to the hospital for a few days and treat her with intra-uterine radium. X-ray treatment is given in 10 doses of 300 r each at intervals of 2 days, making a total dosage of 3,000 r. We give intra-uterine radium dosage of 2,000 mgh. or slightly less to ensure a complete and permanent amenorrhea. The mortality of irradiation by either method is practically nil.

The contraindications to irradiation which we observe are listed below:

1. Any fibroid occurring in a woman under 40 should not be irradiated unless surgical treatment is contraindicated. The artificial menopause induced by irradiation should be avoided and can be avoided by conservation of ovarian tissue when surgery is done.

2. When the diagnosis is questionable, as for example when a fibroid cannot be differentiated with certainty from an ovarian tumor.

3. When the fibroid is larger than a 3½-months' pregnancy. Larger tumors are apt to produce pressure symptoms that are best relieved by surgery. They are also apt to contain areas of degeneration; hence, they should be removed rather than irradiated.

4. When there is a complicating old or recent pelvic infection. Irradiation may light

up the inflammatory processes. Salpingitis, complicating fibroids, usually causes pain which is an indication for surgery.

5. When there is a complicating ovarian neoplasm.

6. When the fibroid is of the pedunculated submucous type. Irradiation of such a fibroid may cause necrosis with resulting serious infection. It will also fail to stop the bleeding.

7. When there is a large pedunculated subserous fibroid that is subject to possible degeneration and/or torsion.

8. When there is complicating malignancy of the cervix, the endometrium or the ovary. Appropriate treatment of the malignancy naturally takes precedence over irradiation of the fibroid.

9. When there is a history of rapid growth before the menopause or, more particularly, when the history suggests postmenopausal growth. This is suggestive of malignant degeneration of the fibroid.

10. When there is abdominal pain, even though the pain is not explained on the basis of any of the above-mentioned complications.

11. When there is some other condition requiring surgical relief, such as retroposition, prolapse, cystocele, relaxed vaginal outlet or rectocele.

#### TOTAL VS. SUBTOTAL ABDOMINAL HYSTERECTOMY FOR BENIGN CONDITIONS OF THE UTERUS

From a review of recent gynecologic literature it is apparent that abdominal hysterectomy, both total and subtotal, has become a relatively safe operation in the hands of competent gynecologists. It is also apparent that there has been a great shift toward total hysterectomy in recent years. In fact, in most clinics total hysterectomy has become the routine method of removal of the uterus. In our opinion, this trend toward total hysterectomy is justified, but we do not believe that it should be made an absolutely routine procedure.

In weighing the two procedures one should balance the advantages of removal of the cervix against the possibilities of an increased morbidity and mortality for the total operation. The advantages of removal of the cervix are that it is eliminated as a possible source of a troublesome discharge and also

as a site where carcinoma may develop. The incidence of the development of carcinoma in the retained stump can only be estimated, since the true incidence cannot be determined except by following until their death a group of women who have been subjected to supravaginal hysterectomy. So far as we know, this never has been done, and the difficulties of such a study are obvious. The incidence of stump carcinomas, in relation to the total of cervical carcinomas, lies in the neighborhood of 3 per cent. This percentage has been quoted incorrectly at times as the incidence of the development of carcinoma in the retained stump; obviously, the true figure is much smaller. Scheffey made a follow-up study on 554 supravaginally hysterectomized women and found carcinoma in the cervical stump in 0.9 per cent of the cases. These were found from 6 to 21 years after the operation; hence, probably none was present at the time of operation. We have encountered personally only 2 cases of cervical carcinoma in women upon whom a supravaginal hysterectomy was done in our private practice. I should estimate that this does not represent an incidence of over 0.2 per cent. Wetterdal found malignancy in the cervical stump in 0.7 per cent of 288 women 10 years after a subtotal hysterectomy and contended that those who use total hysterectomy routinely have an exaggerated fear of cervical cancer. However, the retained cervix does constitute a possible source of leukorrhea and bleeding. Cariker and Dockerty studied 334 retained cervixes of women who complained of symptoms referable to the cervix. Bleeding was the commonest complaint and was explained by both benign and malignant lesions. Twenty-three per cent of the cervixes proved to have cancer, and they concluded that *total* removal of the uterus was desirable, a conclusion with which we would heartily agree. During the past several years we have studied thoroughly all cervixes removed in performing total hysterectomy for supposed benign disease. In each instance the entire cervix was cut into blocks, and many, many sections were taken from each block. In the course of this thorough examination of 1,500 cervixes, very early but undoubted cancer was found in 0.6 per cent.

In attempting to judge the relative safety

of the two operations one can prove that either procedure is safer, depending upon one's interpretation of figures found in gynecologic literature. Weir reports a mortality rate of 0.767 per cent in 1,436 total hysterectomies. The mortality rate in his series of 1,914 hysterectomies, of all types, was 1.2 per cent. Since this figure includes subtotal hysterectomies, obviously the mortality is higher in the subtotal group. Pearse reports on 1,243 supravaginal and 373 complete hysterectomies; the mortality rate of the series of the total operation was 2.9 per cent, while for the subtotal group it was 3.4 per cent. Danforth reports a mortality rate of 0.8 per cent for the subtotal operation and 0.66 per cent for the total. Masson reports a mortality of 1.3 per cent for the total operation and 1.8 for the subtotal. Most of these statistics are relatively old, and recent statistics from the better clinics show lower mortality for both groups of cases. For example, in 1,000 successive abdominal hysterectomies in our clinic Woodruff found only 2 deaths. Both of these were from pulmonary embolism. Also in 1,000 vaginal hysterectomies, many of which were done for small fibroids, the mortality was also 0.2 per cent. There were 2 deaths among the last 1,000 hysterectomies of both types, and both of these were due to pulmonary embolism. There was no mortality among the total hysterectomies. From the above figures one may justly conclude that either operation is relatively safe. However, to conclude that total hysterectomy is safer than subtotal would be to disregard the fact that the group of the subtotal operation usually includes the more difficult cases and the poorer operative risk. For example, in those clinics in which total hysterectomy is the rule, it is common for the operator to perform quickly a subtotal amputation when he encounters operative difficulties and/or is informed by the anesthetist that the patient's condition is critical. These cases are included in the subtotal group from which statistical data are compiled. Such data obviously cannot be used to prove the greater danger of subtotal hysterectomy, for the patient may be almost moribund when the decision for a subtotal hysterectomy is made.

As to morbidity, it is difficult to compare the two operations statistically. Danforth re-

ports a morbidity of 28 per cent for the subtotal operation and 33 per cent for the total, but this slight difference, based on temperature elevation, is of little significance and does not tell the whole story. Today, in the better clinics, the incidence of ureteral and bladder injury is very small with either operation; however, the larger clinics are often called upon to repair damage done to ureters and bladders by less experienced operators. We have observed, as have also Norman Miller and Holden, an increased incidence of vesicovaginal fistulas resulting from total abdominal hysterectomies.

In view of the above considerations, what is the proper attitude in respect total versus subtotal hysterectomy for benign uterine disease? On the gynecologic service at the Johns Hopkins Hospital we have done total hysterectomy in approximately 96 per cent of our cases in recent years. This percentage is lower than in some clinics and is lower than the percentage on the private service. It includes the operations done on the colored ward where fibroids often are extremely large and the complication of salpingitis is encountered more often than not. It is on these patients, particularly, that we occasionally perform the subtotal operation. We are inclined to attribute our very low mortality quoted above to the judgment which the staff exercised in selecting the proper operations in each case. I sincerely hope that our percentage of total hysterectomy never reaches 100. If it should, I would be inclined to believe that we had thrown clinical judgment to the wind. There are times in all surgery where discretion is the better part of valor.

In general, it is assumed on our service that a total hysterectomy will be done, and the cervix is left in only when, in the opinion of the operator, there is some good reason for doing so. Briefly stated, it may be said that when it is believed that the danger of removal of the cervix exceeds the danger of leaving it, the subtotal operation should be done.

#### OVARIAN CONSERVATION AT HYSTERECTOMY

Ovarian conservation versus ablation is considered in the chapter on hysterectomy because the question of removal of normal

or relatively normal ovaries occurs most often when hysterectomy is done for benign disease. The problem is an ancient one, and unfortunately the final answer is not yet forthcoming. Opinion in recent years has swung more to ovarian conservation. There are few active gynecologists today who follow the precept of Graves who advocated the routine removal of ovaries in all women on whom hysterectomy was done, regardless of age. Among them are Duncan and Grogan who in their recent writing state: "It was the considered opinion of the authors that the interest of the patient was best served by prophylactic castration (as opposed to ovarian salvage) and the institution of adequate hormonal substitution therapy which would serve to prevent postoperative occurrence of the menopause syndrome." At the other extreme are some gynecologists who practically never remove normal ovaries even though the patient is well past her menopause. Then there are many who routinely practice ovarian olation after 45 when hysterectomy is done.

The question of the function of ovaries left in after hysterectomy has never been entirely settled. Grogan studied 30 residual ovaries that required removal. Sixty per cent contained either active corpora lutea or normally developing follicles. One of these ovaries was 16 years posthysterectomy. Wharton and Te Linde have recently studied the problem, using monkeys. They found no evidence that either subtotal or total hysterectomy had any effect on the remaining ovaries 2 years after the hysterectomy as judged by the histology of the ovaries. Corpora lutea and follicles of all stages of development were found in the postoperative ovaries exactly as in ovaries with the uterus left in situ. It must be remembered that Grogan's study, showing 60 per cent of histologically normal ovaries, was made on ovaries which in his estimation required surgical removal. The percentage would undoubtedly be much higher if based on all residual ovaries. From the above studies, together with the clinical evidence which is observed daily in every gynecologist's office, it would seem that ovaries left in young women with good blood supply continue to function normally. I refer to the appearance of flushes and other menopausal

symptoms appearing in the late forties and the early fifties in women who had a hysterectomy with ovarian conservation early in their menstrual life.

In recent years the question of ovarian function after the menopause has created considerable interest. Randall has been particularly interested in this phase of the subject. He attempted to estimate estrogen activity by vaginal smears in women after the cessation of their periods. He studied smears on women from 2 to more than 15 years after their last period and found a persistence of estrogen effect in 55.2 per cent. On comparing a group of women who had been castrated with a group of comparable ages who had had simple hysterectomy, there was evidence of estrogen deficiency in 30 per cent more of the castrated women than in the noncastrated. If these vaginal smear interpretations can be considered as really indicative of estrogen activity, it is apparent that many women receive estrogen from an extra-ovarian source. On the other hand, it is equally obvious that depriving a woman of her ovaries deprives her of her principal source of estrogen.

One wonders how significant the vaginal smear is in determining significant estrogen activity. Green, for example, attempted to estimate ovarian function on 335 women, who were at least 2 years postmenopausal and had had no estrogen therapy, by studying the endometrium. He found 4 women in whom he judged there was estrogen activity among this group; 3 had endometrial hyperplasia, and 1 had proliferative endometrium. The finding of active-looking endometrial hyperplasia in postmenopausal women is not nearly as common as might be expected if the cytologic studies of Randall are significant of substantial estrogen activity.

Wuest *et al.* have stated that women whose ovaries had been surgically removed early in life developed a degree of atherosclerosis not seen among normal women until they are 20 or more years older. Harkins and Frankel noted in their series that 17.4 per cent of noncastrated women dying before 50 died of vascular disease, whereas among 37 castrated women dying before 50 death was due to vascular disease in 80 per cent. However, these deductions are taken from small groups



of women, and one wonders as to their statistical significance. Novak and Williams have approached this same problem by studying the autopsy material on 2 groups of women of comparable ages. One group had been castrated at various intervals before death, and the other had not. A study of the cardiovascular organs of both groups was done by various pathologists in making routine autopsies. There was no discernible difference in the 2 groups.

So-called senile osteoporosis and the "postmenopausal" bone changes are regarded by many as essentially the same type of deficiency. A lack of estrogens and androgens seems to be an important factor in such bone changes. The role of estrogenic hormonal deficiency in osteoporosis in postmenopausal women seems to be evident to some observers, since in most reported series women outnumber men of equal age 3 or 4 to 1.

Regardless of what the correct answer may be regarding postmenopausal ovarian function, there can be no doubt of the undesirable effects of castration in the young. In addition to hot flushes, headaches and general nervous instability, the local changes in the vagina are of great importance. The contracted vaginal outlet and the atrophic sensitive vaginal mucosa result in dyspareunia which may be very troublesome to the woman past 50 who has undergone her natural menopause; to the young woman it may constitute a major tragedy and even wreck her marriage. Although substitutional hormonal therapy is helpful in relieving the general and the local symptoms of castrations, it seldom equals the beneficial effect of the normally secreted estrogen.

Against the disagreeable symptoms of the menopause one must balance the possibility of malignancy developing in retained ovaries. Counseller has reported 65 such cases, but since the relation of these cases to the total number of hysterectomies done is not available, the figure has no percentile meaning. Randall, on good statistical grounds, has estimated that the retained ovary at 40 has slightly less than a 1 per cent chance of becoming malignant. After 40 the percentage decreased. Benign tumors may also occur. After 50, Randall found 14 ovarian neoplasms per thousand women; 6 of these were benign, and 8 malignant.

From available evidence it would seem illogical to remove normal-appearing ovaries in women under 45, but what is the correct decision in the woman over 45 whose normal menopause is probably only a few years in the future?

The author considers the following factors:

1. *Temperament of the Patient.* We would be more inclined to spare at least 1 ovary in a woman whose temperament would indicate that the added psychic disturbance associated with the menopause would aggravate her already delicately balanced emotional status.

2. *Age of the Patient.* Within the limits of 45 and 52 or 53 we would be more inclined to perform oophorectomy toward the end of this period.

3. *Appearance of the Ovaries.* Often in this age group, there is a great variation in the appearance of the ovaries. In some individuals at 50 the ovaries appear to be quite youthful. There is no evidence of atrophy, and even a fresh corpus luteum may be present. Often there is quite a contrast between the 2 ovaries in the same individual. One or both ovaries might be spared on the basis of their youthful appearance. I would be especially inclined to spare such an ovary if the woman is youthful in appearance for her years, suggesting a persistence of good estrogen activity. The removal of 1 ovary does not reduce the incidence of subsequent ovarian neoplasm by 50 per cent, because some ovarian tumors, benign and malignant, are bilateral from their incipency.

#### TECHNIC: SUBTOTAL ABDOMINAL HYSTERECTOMY

Since the operation of subtotal abdominal hysterectomy is done most often for myomata, the great variation in size and shape of the uterus makes it necessary to deviate from any standard technic and, frequently, to improvise as one proceeds. Also, the complication of adnexal disease may prevent the carrying out of a uniform procedure. However, the surgeon should have some standard plan from which he can make any modifications that become necessary in the course of the operation. Such a standard technic is presented here:

One of the round ligaments is grasped with an Ochsner clamp near the uterine cornu and

FIG. 148. Subtotal abdominal hysterectomy. (A) Round ligament has been ligated and cut, thus opening the anterior leaf of the broad ligament. Avascular area in the broad ligament is exposed and is being incised.

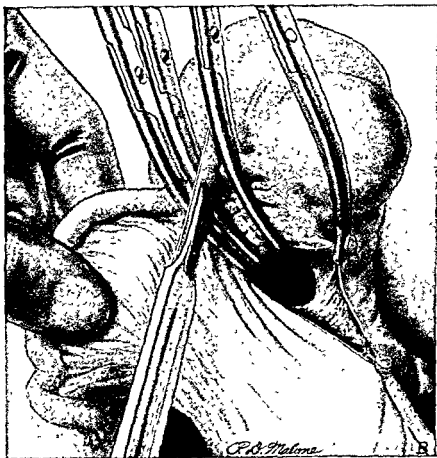
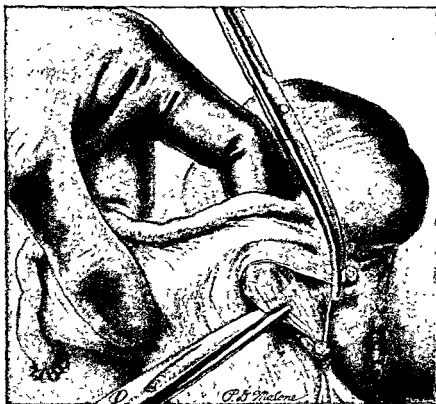


FIG. 148 (Continued). (B) The tube and the ovarian ligament are doubly clamped and cut as indicated by dotted line.

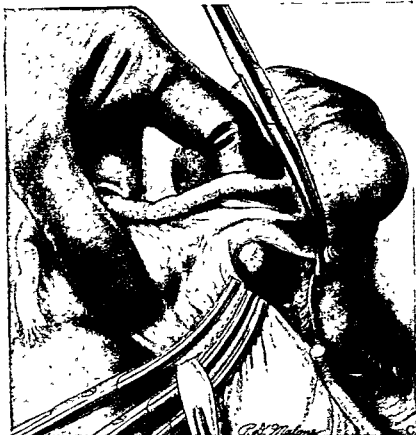


FIG. 148 (*Continued*). Subtotal abdominal hysterectomy. (C) When adnexa are to be removed, the infundibulopelvic ligament is doubly clamped and cut.

is ligated a short distance distal to the clamp with No. 0 chromic catgut. The ligament is cut between the clamp and the ligature. Thus, the anterior leaf of the broad ligament is opened. The posterior leaf of the broad ligament is pushed forward through this opening with the surgeon's finger as shown in Figure 148 A. This portion of the broad ligament is quite avascular. It is incised with the scissors.

The next step depends upon whether the tube and the ovary are to be saved or removed. If they are to be saved, the tube and the ovarian ligament are triply clamped en masse as in Figure 148 B. The clamp in proximity to the uterus is to control back bleeding, and the incision is made between it and the next clamp. Thus, the ovarian vessels are doubly clamped as they approach the anastomosis with the uterine. Double clamping of the ovarian vessels is our usual routine, and we believe that it is an excellent precaution. It prevents slipping and retraction of the cut vessels with the formation

of a broad ligament hematoma. Furthermore, this ligation must be in the nature of a mass tie, and the crushing of the tissues by means of the second clamp affords a groove in which to tie the first suture ligature. The proximal clamp is removed as the suture ligature is tied, and the distal clamp is kept in place. Then the mass of tissue is transfixed with another suture of No. 0 chromic catgut distal to the first ligature as the distal clamp is removed.

There are instances in which the double-clamp technic cannot be used, but when it is feasible we believe it to be a worth-while precaution.

If the tube and the ovary are to be removed with the uterus, the infundibulopelvic portion of the broad ligament is clamped with 3 Ochsner clamps en masse as shown in Figure 148 C. The ligament is divided, and double ligation of the ovarian vessels by suture ligature of No. 0 chromic catgut is carried out. In general, it is good policy to

ligate the clamped ovarian vessels as they are cut, rather than to leave all the clamps on until after the uterus is removed. By ligating them as one proceeds the operative field is cleared of clamps, and if at any stage of the operation fast decisive action is necessary there is less cluttering of the field by clamps which might have been disposed of earlier.

Clamping, cutting and ligating of the round ligament, the uterine end of the tube and the ovarian ligament or of the infundibulopelvic ligament are carried out in the same manner on the opposite side.

Next, the posterior leaf of the broad ligament on either side is cut parallel with the side of the uterus (Fig. 148 D). This step is not always done, although with large tumors cutting of the broad ligament often better demonstrates the uterine vessels between the leaves of the broad ligament for clamping.

The reflexion of the bladder peritoneum onto the uterus is then picked up in about the mid-line, and it is cut as indicated in Figure 148 E. The incision through the peri-

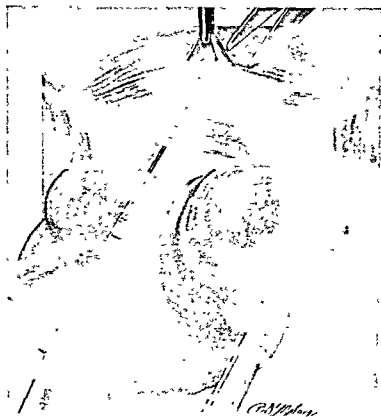


FIG. 148 (Continued). Subtotal abdominal hysterectomy. (D) The posterior leaf of the broad ligament is cut to secure better exposure of vessels for clamping. Often this step is not necessary. (E) Reflexion of the bladder peritoneum onto the uterus is cut, as indicated by dotted line joining the round ligaments.



FIG. 148 (Continued). Subtotal abdominal hysterectomy. (F) Uterine vessels are doubly clamped, and clamps are also placed to control back bleeding. The line of amputation is indicated by a dotted line.

toneum is carried laterally to the regions of the cut ends of the round ligaments. In cutting the peritoneum, care should be taken not to cut too deeply. If the cut is made just through the peritoneum a good line of cleavage is entered, but if the cut goes too deeply, bleeding will be encountered. With a sponge on a sponge holder, or with the finger, the bladder peritoneum usually can be dissected down easily by blunt dissection. In the usual subtotal hysterectomy the bladder itself need be freed from the cervix little or none. Bleeding will be prevented by avoiding unnecessary dissection of the bladder from the cervix but when a very low amputation of the cervix is desired, freeing of the bladder may be carried down to as low a point as necessary to carry out the amputation.

The uterine vessels that have been thus exposed are then triply clamped bilaterally with curved Ochsner clamps, as indicated in Figure 148 F. It is not necessary to dissect out these vessels for clear visualization; in fact, to do so may cause unnecessary bleeding. It is desirable to have these clamps that crush the loose tissue enveloping the uterine vessels bite into the edge of the cervix as

shown in Figure 148 H. Of course, the upper clamp is intended to prevent back bleeding from the uterus, but the 2 lower clamps doubly clamp the uterine vessels. Then the corpus is amputated as indicated in the dotted line in Figure 148 F. The level of this amputation is variable, depending upon circumstances. If it is desired to leave a little endometrium to permit a show of menstruation, the amputation may be done above the internal os. If, on the other hand, the endocervix is the source of leukorrhea and for some reason a total hysterectomy is not thought to be advisable, the amputation may be done very low, leaving almost no cervix. Regardless of the level of amputation, it is well to make a V-shaped cut as illustrated in Figure 148 G. This facilitates the closure of the stump.

The uterine vessels are doubly ligated with No. 0 chromic catgut, according to the preference of the operator. These sutures are placed into the substance of the cervix as indicated in Figure 148 H. As the first suture is tied the lower clamp is removed, and if the bite of tissue is large it may be well to loosen the upper clamp to permit the tissue to be

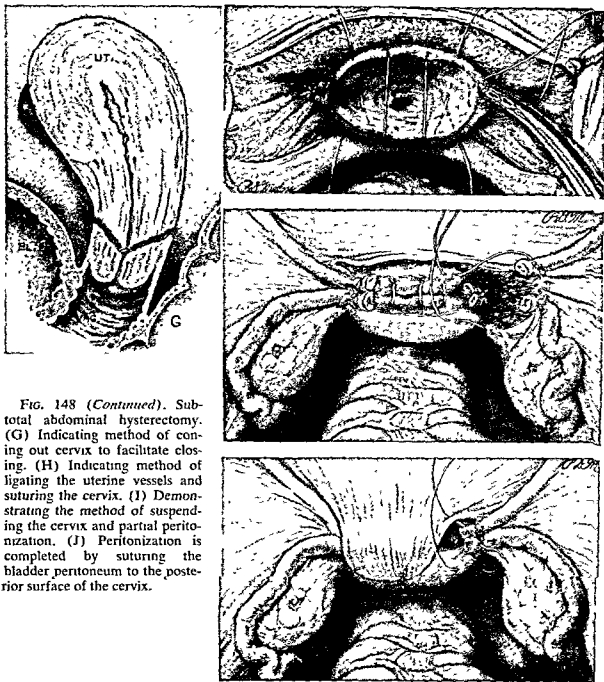


FIG. 148 (Continued). Subtotal abdominal hysterectomy. (G) Indicating method of coning out cervix to facilitate closing. (H) Indicating method of ligating the uterine vessels and suturing the cervix. (I) Demonstrating the method of suspending the cervix and partial peritonization. (J) Peritonization is completed by suturing the bladder peritoneum to the posterior surface of the cervix.

compressed tightly by the ligature. As the second ligature is tied the upper clamp is removed. Double clamping is of great value here, for if only one clamp is used and the tissue slips out of the ligature and retracts, the vessels must be caught again in the presence of bleeding. Attempts at clamping such retracted vessels in the basilar portion of the broad ligament may result in injury to the ureter.

The cervical stump is then closed, using

figure-of-eight sutures of No. 0 chromic catgut on cutting needles (Fig. 148 H).

Next, the cervical stump is suspended by suturing the various ligaments to it. Figure 148 I shows this step when adnexa on both sides have been saved. The chromic catgut suture is first placed through the anterior surface of the cervix. It then picks up a bit of the round ligament. A bite or two is taken in the peritoneum between the round ligament and the tube. The tube to which the

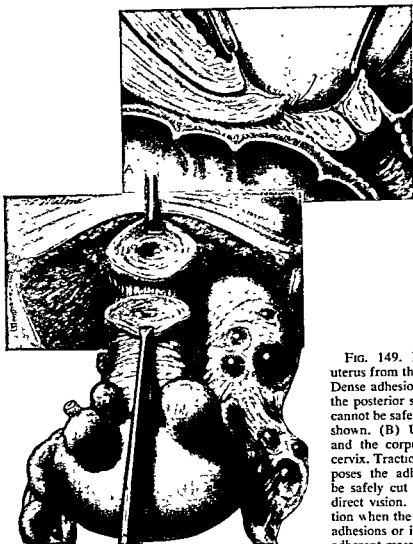
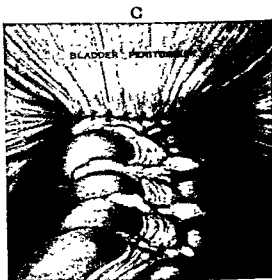


FIG. 149. Method of dissecting the uterus from the adherent rectal wall. (A) Dense adhesions between the rectum and the posterior surface of the uterus which cannot be safely separated from above are shown. (B) Uterine vessels are ligated, and the corpus is amputated from the cervix. Traction on the uterus upward exposes the adhesions which can usually be safely cut from below upward under direct vision. (C) Method of peritonization when the cul-de-sac is obliterated by adhesions or is raw due to freeing of the adherent mass from the cul-de-sac.

ovarian ligament has been tied is next included. One or two bites are taken in the posterior leaf of the broad ligament. In picking up the broad ligament one should be careful to include only the peritoneal edge under vision, because if bites are taken recklessly into the posterior leaf it is possible to include the ureter in the suture. Finally, a bite is taken in the posterior surface of the cervix. An assistant grasps the ends of the round ligament and the tube as the suture is tied over them. This suture not only suspends the cervix but also partially peritonealizes the pelvis.

In case the adnexa have been removed, the suspension and the peritonealizing are done somewhat differently. In some cases the infundibulopelvic ligament is sufficiently mo-



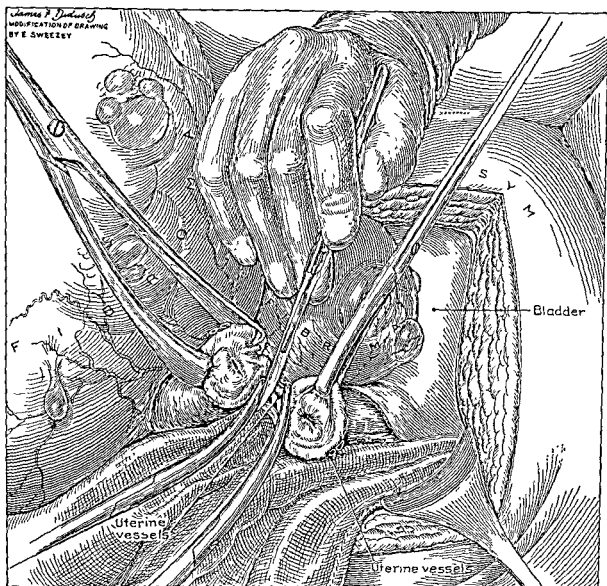


FIG. 150. Supravaginal amputation of a fibromatous uterus from right to left. The right uterine vessels have been clamped, cut and tied. The left vessels are clamped as they are approached and are about to be cut.

bile to be brought down to the cervix without tension, but often it is not. The leaves of the broad ligament are approximated with a continuous stitch of No. 000 chromic catgut, and the stump of the infundibulopelvic ligament is buried between the leaves of the ligament by a purse string.

The peritonization of the cervical stump is carried out by suturing the edge of the bladder peritoneum to the posterior surface of the cervix, using either interrupted or continuous No. 000 chromic catgut. To ensure covering over the cut ends of the ligaments

and the tubes, it is often desirable to pick up these structures with the suture as indicated in Figure 148 J, to cause them to invert beneath the serosa.

Due to the growth of the tumor and complicating adhesions, variations in the above-described technic of subtotal hysterectomy are common. For example, adhesions between the fibroid uterus and the anterior rectal wall often occur, and it may be impossible to sever them safely under vision from above downward. In such cases the corpus may often be amputated at the cervix



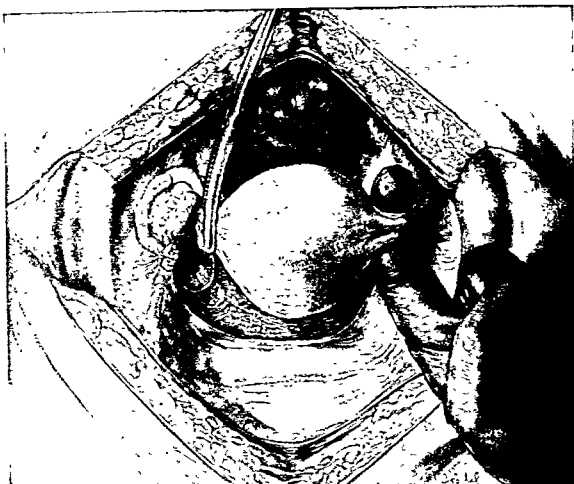


FIG. 151. Conservative total hysterectomy, Richardson technic. (A) The vesicouterine peritoneum has been incised transversely. The left round ligament, the fallopian tube and the utero-ovarian ligament are shown resting upon the index finger which has perforated the broad ligament. On the opposite side these structures have been divided and ligated. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48:252-256)

and the adhesions cut safely from below upward. Figure 149 A shows such adhesions on sagittal view, and Figure 149 B shows them as they are visualized by the operator. Peritonization of the cervical stump in such cases is sometimes best done by lightly suturing the bladder peritoneum to the anterior rectal wall, which is still adherent to the cervical stump (Fig. 149 C).

One of the commoner surgical maneuvers performed in our clinic is the side-to-side amputation described by Kelly in 1898 in his *Operative Gynecology*. The difficulty in dissecting down to the uterine vessels on one side may be due to the development of a fibroid laterally to such an

extent that no space between it and the pelvic wall can be developed to permit clamping of the uterine vessels. Often a large intraligamentary tumor serves as a barrier that cannot be circumvented. It may also be due to a fixed, old adnexal inflammatory mass through which safe dissection is quite impossible. If, under such circumstances, the region of the uterine vessels can be reached on one side, they may be clamped, cut and, if possible, ligated. The amputation is then made from that side to the opposite side, and the uterine vessels are clamped as they are approached (Fig. 150). If space permits, double clamping is desirable. Traction can best be made on the lower portion of the

uterus with the volsellum as shown in Figure 150. This controls back bleeding, and when there is bleeding from the uterine cavity, it is prevented from soiling the operative field.

As the amputation is done, an assistant grasps the cervical stump with a Jacobs tenaculum. By keeping traction on this, the danger of retraction of the cervix is prevented.

After the base of the broad ligament is opened, dissection of the adnexal or fibroid mass from beneath usually can be done with less difficulty and greater safety. When there is an adherent adnexal mass, the infundibulopelvic ligament is often the last structure to be clamped, as it is isolated after the mass is freed from below upward.

### TOTAL ABDOMINAL HYSTERECTOMY FOR BENIGN UTERINE DISEASE (RICHARDSON TECHNIC)

When in our judgment total abdominal hysterectomy is indicated for benign uterine disease we remove the uterus, using the technic as described by E. H. Richardson (Fig. 151 A to K). Slight modifications in technic are made at times by different operators. The technic as originally described by Richardson is given here. Certain modifications are discussed in the pages immediately after the following description.

*Technic of the Operation.* 1. The bladder and the rectum should be empty. Preliminary, thorough surgical toilet of the vulva, vagina and

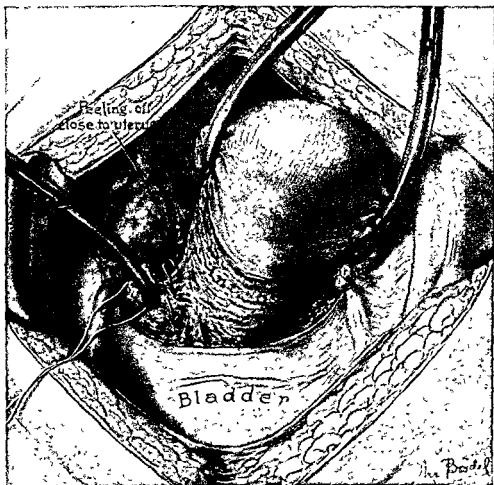


FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (B) The right uterine vessels are shown clamped and divided with a ligature placed around them. The arrows indicate the line of dissection used to drop these vessels, together with the attached ureter, well away from the danger zone. (Richardson, E. H. A simplified technic for abdominal panhysterectomy, Surg., Gynec. & Obst. 48:252-256)

cervix is first carried out. In addition, the entire vagina, vaginal portion of the cervix and, particularly, the external os and cervical canal are thoroughly treated with the official tincture of iodine, 20 per cent Mercurochrome or Scott's solution. The external os is then tightly closed by aseptic suture, and a dry sterile gauze pack is introduced into the vagina, one end of which is left outside to which a clamp is attached, so that it can be readily withdrawn just before the vagina is opened above. The

usual surgical toilet of the abdominal wall is then made and the sterile draperies are properly arranged.

2. A lower mid-line incision is made from the symphysis pubis to the umbilicus.

3. Adequate exposure of the pelvis is secured through use of the Trendelenburg position, together with the judicious use of wet gauze packs.

4. The body of the uterus is now grasped firmly with an appropriate instrument and



FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (C) Here the bladder is being gently separated from the cervix by blunt dissection applied to its avascular central zone. Note that this dissection leaves the pubocervical (subvesical) fascia covering the cervix. To this structure the troublesome venous plexus is attached. Utilization of this anatomic fact to advantage is described in the operative technic. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48:252-256)

lifted well up, provided only that its pathology is known to be benign in character.

If, however, malignancy has been demonstrated or is suspected, the operation must be modified to include removal of both tubes and ovaries, and it is particularly stressed that no no compression whatever should be applied to the uterus, either by instruments or by the surgeon's hands, until its extrinsic blood and lymphatic channels have been absolutely blocked by ligation and division of its four cardinal circulatory trunk systems, namely, the two ovarian and the two uterine. This I believe to be a sound and effective precaution

against the possible dissemination of malignant cells by squeezing them out into adjacent vascular currents.

5. A transverse, crescent-shaped incision is now made through the vesico-uterine peritoneum at the upper margin of its loose attachment to the uterus and is carried laterally on each side to the uterine attachment of the round ligaments.

6. Into the angle of this incision on each side the index finger is introduced and burrowed bluntly through the loose areolar tissue of the upper portion of the broad ligament, perforating its posterior layer close to the

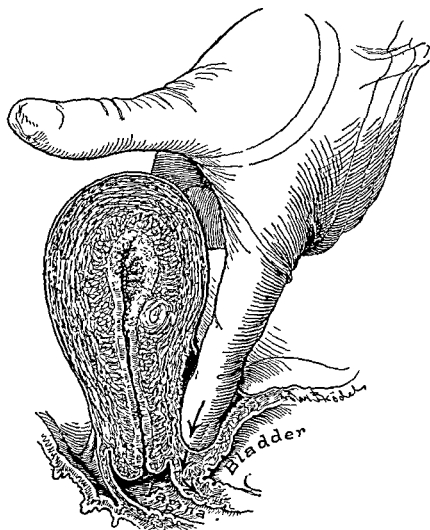


FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (D) A sagittal view showing depth and direction of the vesico-cervicovaginal dissection. This step serves to drop the ureters still farther away from the danger zone. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48: 252-256)

uterus and below the level of attachment of the round ligament, the fallopian tube and the utero-ovarian ligament.

7. This aperture is bluntly enlarged sufficiently to permit the approximation of these three structures to form a single pedicle, to which two stout clamps are applied, and amputation is done between them close to the uterus.

8 Transfixing ligatures replace the two clamps on the severed appendage stump, while the two applied to the cornua of the uterus

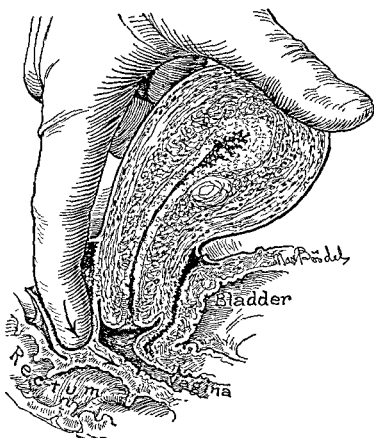
are henceforth used as tractors. The original instrument with which the body of the uterus was grasped for the purpose of elevating it is now removed.

9. Traction upward upon the uterus now brings clearly into view the skeletonized uterine vessels, which are clamped and divided on each side at the level of the internal os. Ligatures replace the clamps on these vessels, care being exercised not to include any cervical tissue in passing the needle.



FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (E) By means of the cornual traction clamps the uterus has been lifted strongly upward and forward over the pubis. A transverse peritoneal incision has been made 1 cm. above the attachment of the uterosacral ligaments. The method of applying blunt dissection to the avascular midsection of the cervix and the upper vagina is indicated. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, Surg., Gynec. & Obst. 48:252-256)

FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (F) A sagittal view showing the bladder dissection completed and indicating depth and direction of the posterior dissection. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48:252-256)



10. The severed uterine vessels, with ease and safety, may now be bluntly dissected away from the cervix down to the point of their emergence above the thick basal segment of the broad ligament on each side.

11. The uterus is drawn strongly upward and the bladder is easily separated by blunt dissection with the gauze-covered index finger first from the cervix and then from the anterior vaginal wall well down below the level of the external os. In most instances the line of cleavage along the course of least resistance here is between the bladder and the pubocervical (subvesical) layer of fascia, so that, after the bladder has been pushed well down, close inspection of the cervix anteriorly will disclose that it is covered with a thin but definite layer of fascia. It is in this fascia that the troublesome vascular plexus is contained. If now a T-shaped incision be made through the fascia with the transverse cut a little below the level of the internal os and the vertical one over the middle of the cervix, the fascia layer together with the vessels may be easily freed from the cervix with the index finger and pushed laterally on each side, so that the vessels are nicely segregated adjacent to the basal segments of the broad ligaments.

Steps 10 and 11 serve further to drop the ureters well away from the cervix where damage to them is scarcely possible, if reasonable care is exercised in the subsequent application of clamps and sutures.

12. Strong traction upward and forward is exerted upon the uterus, and a transverse incision is made through its posterior peritoneal reflection one centimeter above the level of attachment of the two uterosacral ligaments. The lower peritoneal flap resulting is quite firmly attached to the posterior wall of the cervix, and sharp dissection vertically downward for at least two centimeters is necessary in order to free it sufficiently to permit introduction of the left index finger. Below this level the peritoneal and rectal attachment is quite loose, and blunt dissection is now utilized, first to free the peritoneum from the cervix, and then is continued downward to release the rectum from the vagina below the level of the external os. Bleeding does not occur in this step of the operation if care is exercised not to carry the dissection laterally on either side into the broad ligament zone.

13. If the uterus now be lifted well up, the two index fingers may readily be apposed below the level of the vaginal portion of the cervix

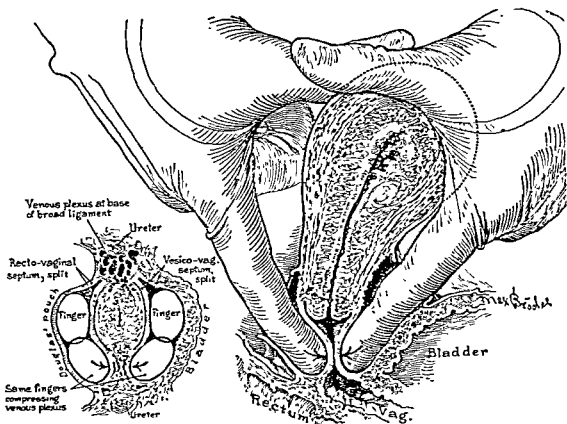


FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (G) Testing the depth of the anterior and the posterior dissections. The inset shows the method of segregating the vascular plexus on each side into a narrow zone adjacent to the basal segment of the broad ligament. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, Surg., Gynec. & Obst. 48:252-256)

by invagination of the anterior and posterior vaginal walls respectively, thus demonstrating that the bladder and rectum have been freed from the vagina sufficiently low down.

14. The two uterosacral ligaments are now clamped, divided and ligated close to their cervical attachments.

15. The dense basal segment of the broad ligament on each side, together with the vascular plexus adjacent to it, which has been segregated through the earlier blunt dissection carried out over the central zone of the cervix in front and behind, may now be easily grasped close to the lateral border of the cervix, divided and securely ligated, the clamps being removed. If the cervix is elongated, this step has to be repeated at a lower level.

16. The vaginal vault now comes up into plain view on all sides, and the sterile gauze vaginal pack is withdrawn from below. Note that even at this stage of the operation there are no clamps in the pelvis and that no trouble-

some hemorrhage has been encountered. The anterior vaginal wall is incised, the vagina promptly balloons, and the incision is extended around the cervix, four clamps being applied to the vaginal vault as it proceeds: one anteriorly in the mid-line, one laterally to each angle and one posteriorly in the mid-line, as the entire uterus is lifted out of the pelvis, without the cervix at any time having come in contact with any intrapelvic tissue.

17. Special angle sutures now replace the two angle clamps as follows: the needle is first passed through the anterior vaginal wall into the lumen of the vagina one centimeter mesial to the angle clamp; it now twice transfixes the stump of the basal portion of the broad ligament, forming within it a liberal mattress suture loop; from here the needle again enters the lumen of the vagina, piercing its posterior wall also one centimeter mesial to the angle clamp and, further, is made to transfix the stump of the uterosacral ligament. When

tied, this suture closes the lateral vaginal angle and snugly apposes to it for support both the strong basal segment of the broad ligament and the uterosacral ligament.

18. Further complete or partial apposition of the anterior to the posterior vaginal wall by suture, depending on whether or not drainage is to be employed, is now quickly executed.

19. A single mattress suture on each side now first engages the closed vaginal vault anteriorly and mesially to the angle suture, transfixes the stumps of the round and utero-ovarian ligaments and passes back to engage the posterior vaginal wall opposite the point of entrance. When tied, this suture snugly apposes the round and utero-ovarian ligaments to the vaginal vault, thus affording additional support to the latter and at the same time neatly suspending the ovaries.

20. The cut margin of the vesico-uterine peritoneum is now neatly sewed to the free

edge of the posterior peritoneal flap, so that the pelvis is completely peritonealized with the vaginal vault and the ovaries strongly supported.

*Modification A.* If for any reason unilateral or bilateral salpingo-oophorectomy is indicated, the technic described becomes even simpler and is readily modified according to well-established procedure to meet this requirement.

*Modification B.* If exposure of the cervix for the lower dissection is rendered difficult by reason of a benign pathological condition in the corpus uteri, such as enlargement from a myomatous change, it is recommended that a subtotal hysterectomy at or above the level of the internal os first be done. The cervix may then be easily and speedily removed by means of the technic as described.

#### SUMMARY

The perfected technic of this operation has been gradually developed during the past 4

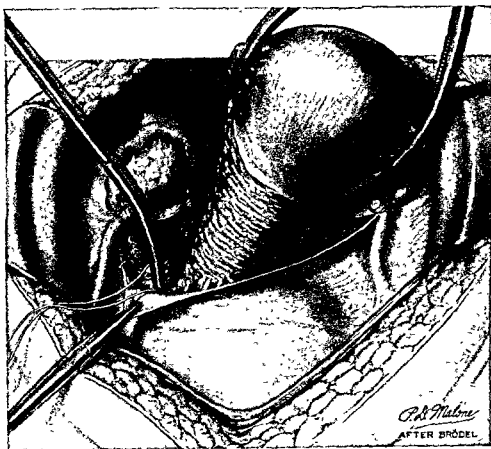


FIG. 151 (*Continued*). Conservative total hysterectomy, Richardson technic. (H) The basal segment of the broad ligament, together with the vascular plexus now segregated adjacent to it, is here shown clamped and divided, with a ligature encircling it. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48:252-256)



years, in which period I have used it a number of times for various types of uterine disease. Thus far I have had no mortality and no post-operative complications, other than the minor ones uniformly associated with any major abdominal procedure. The operation is offered, not with the optimistic fancy that no untoward results will later be chargeable to it, but with the confident belief that it possesses the following distinct advantages.

1. Each step of the operation is anatomically and surgically sound in principle.

2. It is relatively simple, easy of execution and consumes substantially less time than has been hitherto required by most operators for abdominal panhysterectomy.

3. There is complete freedom from hemorrhage or troublesome oozing throughout, which is accomplished by means of a carefully planned anatomic dissection that serves to segregate the vascular network surrounding the lower cervix, so that not more than four hemostatic clamps are required in the pelvis at any stage of the operation.

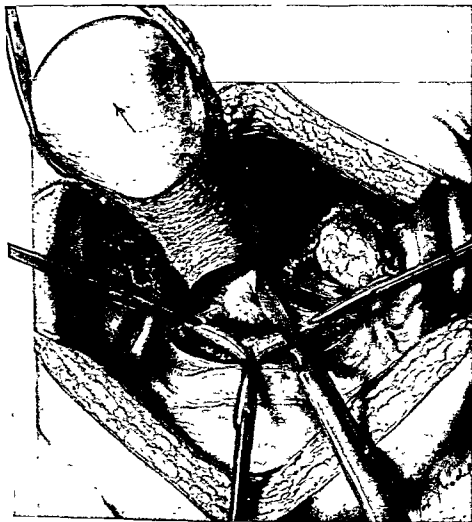


FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (I) The dissection completed, the amputation across the vaginal vault is here shown. This should be done as closely as possible to the cervix in order to avoid shortening the vagina. Note that no instrument comes in contact with the cervix, nor does the latter touch the field of the operation at any time. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48:252-256)

4. The danger of injury to the ureters is reduced to a negligible factor.

5. The accurate identification and preservation of the substantial basal portions of the broad ligaments and of the uterosacral ligaments for later co-adaptation to the vaginal vault by a specially devised suture affords an efficient guarantee against later prolapse.

6. The possible contamination of the field of operation or of the peritoneal cavity from the cervix harboring virulent organisms is reduced to a minimum.

7. The special step recommended in the cases in which malignant disease is suspected

(step 4) constitutes an additional protection against possible recurrence. This is a factor of unquestionable merit.

8. Finally the factors which commonly produce shock and prompt exodus following panhysterectomy, such as excessive loss of blood, extensive mechanical insult to the tissues and prolonged operative manipulations, are completely eliminated through this simplified technic.\*

\* Richardson, E. H.: A simplified technique for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48:252-256, 1929.

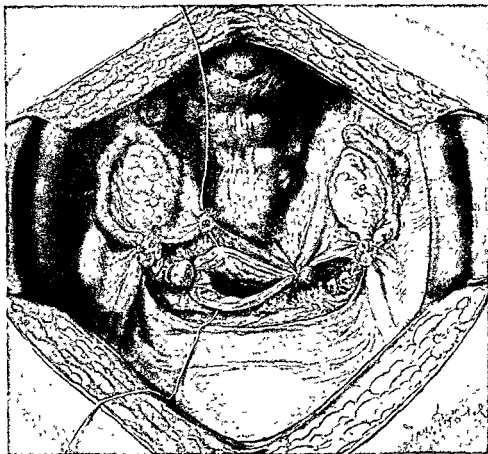


FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (J) Illustrating the highly important angle stitch. Note that it first pierces the anterior vaginal wall 1 cm. from the lateral angle; it then twice transfixes the cardinal ligament to form a liberal mattress loop within this important structure; then it is passed through the posterior vaginal wall also 1 cm. from the angle and finally transfixes the stump of the uterosacral ligament. On the left side this suture has been tied, closing snugly the lateral angle of the vaginal vault and uniting with it the 2 strong supporting ligaments. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, *Surg., Gynec. & Obst.* 48:252-256)

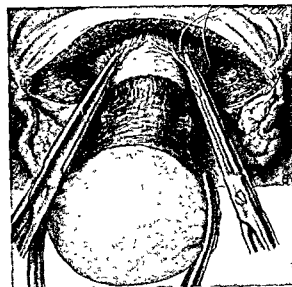
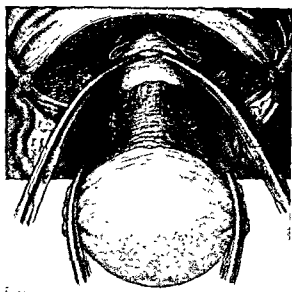
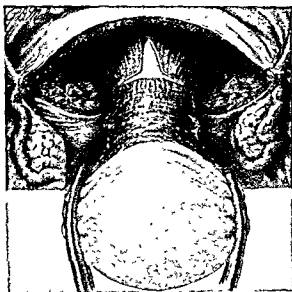


FIG. 152. Modification of Richardson's technic adapted to vaginal closure. (A) Demonstrating T-shaped incision into the pubocervical fascia as recommended by Richardson. (B) The fascial edges with contained blood vessels are clamped and sutured. (C) The vagina is closed as much as possible by placing

2 Ochsner clamps on it from each side just below the cervix. When the vagina is small the ends of these 2 clamps may touch, thus completely closing it. Note that clamps only include the vagina, the fascia having been peeled off and clamped separately. (D) The central portion of the vagina is closed with a figure-of-eight suture of chromic catgut. The portion of the vagina held by the clamp is closed with a mattress stitch which perforates the vagina anteriorly at the nose of the clamp and posteriorly near the vaginal edge.

of cases and never have had occasion to regret it. On the basis of our experience, we now use drainage only in those cases in which the infection of the cervix or the endometrium is thought to be unusually severe. With the use of antibiotics our indications for drainage are becoming rarer and rarer. Within the past 10 years we cannot recall draining a single hysterectomy.

First, we wish to call attention again to the pubovesicocervical fascia, described by Richardson but not pictured in his original series of drawings. The fibers of this fascia extend from the level of the internal os of the cervix, beneath the mucosa of the anterior vaginal wall, to the symphysis. After the reflexion of the bladder peritoneum has been cut and the bladder has been dissected

# COMMENTS ON AND MODIFICATIONS OF RICHARDSON TECHNIC OF TOTAL ABDOMINAL HYSTERECTOMY

The technic of total abdominal hysterectomy above shown is, in the opinion of the author, superior to any thus far described. It is logically planned to ensure complete hemostasis, to keep the pelvis free of interfering clamps at all times and to utilize all ligamentous supports for the vagina. However, in adopting another surgeon's technic it is inevitable that each surgeon should make a few modifications of the operation as originally described. The author has done this without in any way changing the fundamental procedures, with the exception of the matter of drainage, which we have generally abandoned. Since our indications for abdominal panhysterectomy have been liberalized, many of the cervixes removed are not badly infected.

Although we carry out a careful preoperative vaginal toilet as suggested by Richardson, the final step of which is painting the cervix and the vagina with Scott's solution, we do not *routinely* suture the lips of the cervix. When the cervix is the source of a profuse discharge, when there is a pedunculated submucous fibroid peeking through the external os or when there is reason to believe that the endometrial cavity is infected, we carry out the preliminary *suturing of the external os*. After painting the vagina and the cervix with Scott's solution we place a dry sponge against the cervix to absorb any secretions from the cervix or the corpus. This sponge is clamped and left protruding from the vagina so that it can be withdrawn by a nurse just before the vagina is opened.

The original Richardson technic calls for routine vaginal drainage. We have practiced tight closure of the vagina in a large series

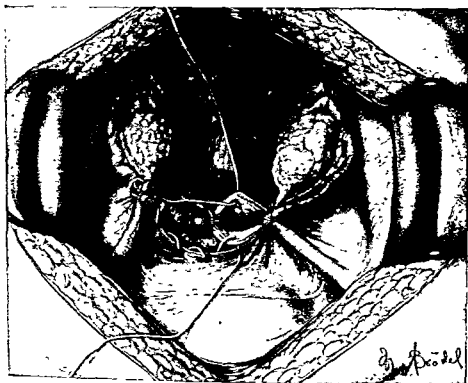


FIG. 151 (Continued). Conservative total hysterectomy, Richardson technic. (K) Left side of the pelvis has been peritonized. Right side is being peritonized in the same manner. (Richardson, E. H.: A simplified technic for abdominal panhysterectomy, Surg., Gynec. & Obst. 48:252-256)

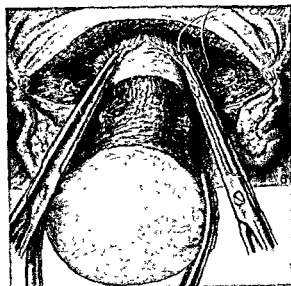
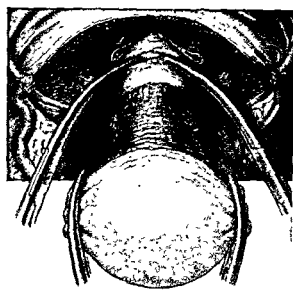
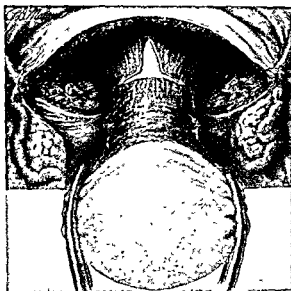


FIG. 152. Modification of Richardson's technic adapted to vaginal closure. (A) Demonstrating T-shaped incision into the pubovesicocervical fascia as recommended by Richardson. (B) The fascial edges with contained blood vessels are clamped and sutured. (C) The vagina is closed as much as possible by placing

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First, we wish to call attention again to the pubovesicocervical fascia, described by Richardson but not pictured in his original series of drawings. The fibers of this fascia extend from the level of the internal os of the cervix, beneath the mucosa of the anterior vaginal wall, to the symphysis. After the reflexion of the bladder peritoneum has been cut and the bladder has been dissected

downward, this fascia is identified readily, and the fibers can be seen running parallel with the direction of the vagina and the cervix. The T-shaped incision in this fascia cut just below the level of the internal os is shown in Figure 152 A. As the edges of the fascia retract laterally the light pink undersurface of the vaginal mucosa comes into view. The cut edges of the fascia usually bleed from the vessels within it. We wish to emphasize that this fascia layer is an important structure, containing blood vessels that supply the upper vagina and the cervix. The proper disposition of this fascia is one of the most important points in carrying out panhysterectomy according to the Richardson technic. Since we have been closing the vagina almost routinely we have modified the Richardson procedure slightly. We now carry out the cutting of the uterosacral ligaments and the freeing of the cervix and the vagina posteriorly, before making the "T"-shaped incision through the pubovesicocervical

fascia. After completing the posterior steps of the operation, the cut edges of the fascia are clamped and sutured immediately after making the anterior fascial incision (Fig. 152 B). This ligation is done with No. 0 chromic catgut.

After the vagina and the cervix have been stripped of the fascia and freed from the basal portion of the broad ligament, only the vaginal mucosa is left, and it is usually thin enough so that the anterior and the posterior walls may be clamped together at either angle as shown in Figure 152 C. For this purpose we have found the Heaney vaginal hysterectomy clamps exceedingly well adapted. Sometimes the vagina is so small that the clamps may be made to meet in the mid-line, thus keeping it completely closed when cut across. In most instances the closure is not complete as in Figure 152 D, but only a small opening is left between the clamps. After the amputation, the center opening is closed immediately with a figure-

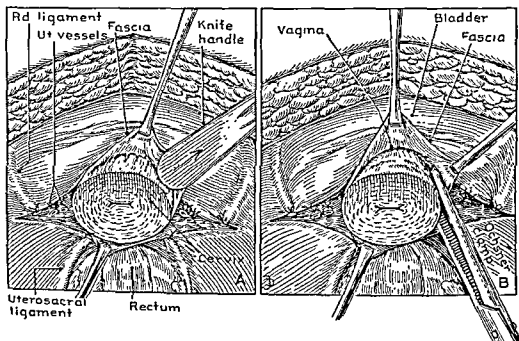


FIG. 153. Showing another method of performing total hysterectomy safely. The corpus uterus has been removed in order to demonstrate the technic more easily. (A) The fascial attachment to the cervix has been cut transversely, and the fascia is dissected free with the handle of the scalpel. (B) The paracervical tissues are clamped with the clamp inside of this fascial sheath. The lateral clamping can be carried down bilaterally to a point below the tip of the cervix. After this the cervix is amputated from the vagina.

of-eight suture of No. 0 chromic catgut, and then the lateral angles are closed as indicated in Figure 152 D. Occasionally, the vaginal walls are so thick that the bilateral clamping is not feasible. In such instances it is better not to persist in the above-described technic but to abandon it in favor of the technic originally described by Richardson.

After the closure of the vagina, it is supported by suturing to it the pubovesicocervical fascia and the various ligaments utilized by Richardson. Since the vagina has been closed already, it is obvious that this must be done by a slightly different technic than that originally described by Richardson. Using No. 000 chromic catgut, the pelvis is finally peritonized completely.

The above method of dealing with the pubocervical fascia was described in the first edition of this book. We still use it as a routine procedure in most of our hysterectomies. However, there are instances in which it is not desirable to dissect the bladder free from the vagina sufficiently far to make the T-shaped incision. Adhesions or varicose veins between the bladder and the fascia may make it advisable to dissect the bladder free as little as possible. In such cases the fascia may be cut transversely at its insertion into the cervix, and the fascia may be dissected free from the vagina with the knife handle. In this manner it is impossible to injure the bladder, and the vessels lying between the bladder and the fascia are avoided. The vaginal clamps are inserted within the space beneath the fascia. These steps are shown in Figure 153.

#### TECHNIC: TOTAL HYSTERECTOMY FOR CERVICAL MYOMA

When total hysterectomy is done for a large cervical myoma the danger lies in possible injury to the ureters, the bladder or the rectum. Because of the enlargement of the cervix, any or all of these structures may be encroached upon and displaced.

Figure 154 A illustrates a large myoma that has developed in the posterior lip of the cervix. Its removal from the vagina was quite impossible because it blocked the entire upper half of the vagina. Therefore, a total abdominal hysterectomy was required to remove this bleeding tumor.

The first part of the operation is exactly like the routine total hysterectomy. However, special technic is required in excision of the cervix from the vagina. A transverse incision is made through the pubocervical fascia, just below its uppermost insertion into the cervix (Fig. 154 B). Then by blunt dissection this fascia is dissected downward from the vaginal wall. This maneuver absolutely safeguards injury to the ureters and the bladder, for if one cuts the vagina within this fascia it is impossible to injure them.

The uterosacral ligaments are sutured and cut, and the peritoneum between these 2 ligaments is also cut. Using the index finger, the dissection is carried downward for a short distance in the mid-line posteriorly between the peritoneum and the vagina. It is assumed that the uterine vessels have been previously cut and sutured.

The vagina is then incised anteriorly where it has been bared of the pubocervical fascia. This exposes the anterior lip of the cervix and also the myoma arising from the posterior lip (Fig. 154 C). The wound is well protected with gauze because the remainder of the operation is not entirely clean, in spite of the most meticulous vaginal cleanup. A traction suture is placed in the myoma, and successive ones are used as the tumor is delivered through the vaginal opening. The vagina is trimmed from the tumor very closely as the tumor is pulled upward. The vaginal mucosa is clamped as necessary with Ochsner clamps. After the cervix has been completely cut from the vagina, the posterior surface is still attached to the anterior rectal wall by loose connective tissue. The cervix can now be dissected free from the rectal wall under vision, from below upward. The closure of the vagina and its suspension are done in a routine manner.

#### INJURY TO THE BLADDER

Injury to the urinary bladder can be avoided by performing the total hysterectomy within the pubocervical fascia. However, there are instances when, due to inflammation or neoplasm, this fascia is not easily dissected. Also, in doing the Wertheim or a modified Wertheim operation the fascia should not be dissected from the cervix or the vagina. When the bladder is injured ac-

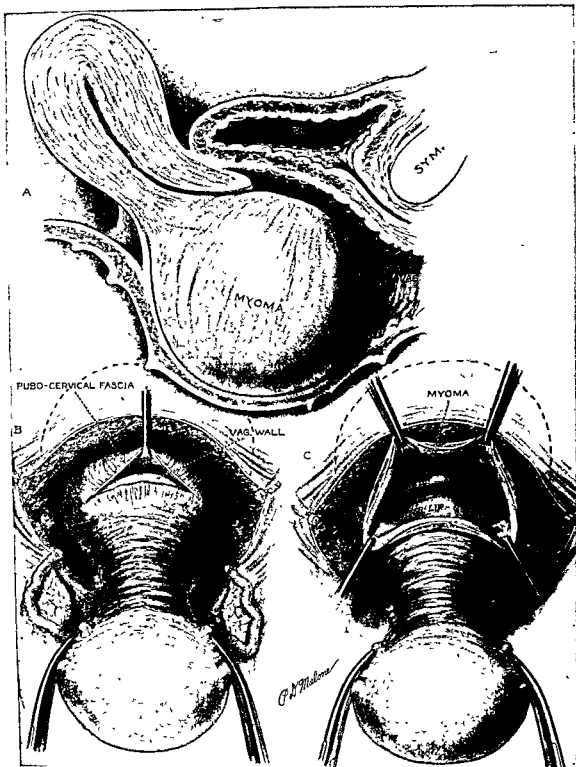


FIG. 154. Total hysterectomy for cervical myoma. (A) Sagittal section showing position of tumor. (B) A transverse incision is made through the pubocervical fascia, exposing the anterior vaginal wall. (C) The vagina has been entered through the anterior wall, exposing the tumor in the vagina. The excision is completed by trimming the tumor from its attachment to the vaginal wall posteriorly.



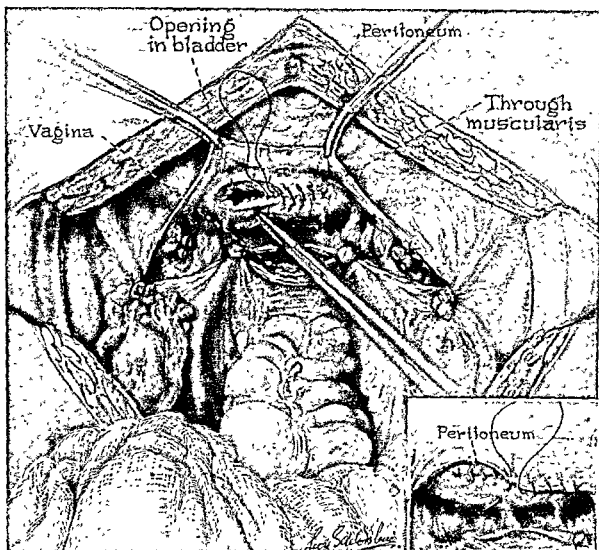


FIG. 155. Closure of accidental opening of bladder while performing total abdominal hysterectomy. The muscularis is closed with a continuous No. 00 catgut suture, inverting mucosa into bladder. The suture line is reinforced by bringing the peritoneum over the first layer of stitches and suturing it in place. This closure is anterior to the vaginal opening to make certain of no leakage into the vagina.

cidentally at operation this is not a serious catastrophe. Indeed, there are occasions when doing hysterectomy for malignancy it is desirable to remove a segment of the bladder with the uterus. Closure of the bladder with a double layer of No. 00 chromic catgut is all that is necessary. The first continuous suture should include the bladder musculature going to but not through the bladder mucosa (Fig. 155). It should be so taken as to invert the mucosa into the bladder. A second continuous suture should invert the first. A retention Foley catheter should be

left in the bladder for 10 days postoperatively. In following this method of closure at the time of the primary operation there has never resulted a vesicovaginal fistula in our institution after abdominal hysterectomy.

#### POSTHYSTERECTOMY HEMORRHAGE

The most common serious posthysterectomy complication is bleeding. Fortunately, serious bleeding does not occur frequently. In a series of 1,000 consecutive hysterectomies reported by Gray there was bleed-

ing sufficient to require resuturing in 0.8 per cent. Nevertheless, when profuse bleeding does occur, it may start suddenly and assume alarming proportions in a remarkably short time so that quick action is imperative and, indeed, may be lifesaving.

Bleeding noted directly after the operation is due to improper suturing of the vaginal cuff and should be attended to immediately by returning the patient to the operating room and suturing the cuff per vaginam. We have never had to reopen the abdomen for this rare complication. The more frequent post-hysterectomy bleeding occurs from the end of the first to the end of the second week. At this time the catgut becomes partially disintegrated, and the sutured vaginal mucosa edges slough and often separate. It is my belief that the rare occurrence of this type of bleeding is quite unavoidable and will occur regardless of the method of closure of the vaginal vault. In reviewing 1,000 cases of hysterectomy with 3 different methods of closure of the vaginal vault, Gray found no essential difference in the incidence of post-operative hemorrhage. A bit of bloody discharge is the rule at the 10th to the 14th day of convalescence. The patient should be reassured. She should not be permitted to take a douche, even though the rather foul-smelling discharge may be annoying to her. Reasonably brisk bleeding may often be controlled by vaginal packing, but one should not temporize too long. As soon as it becomes evident that the packing is not controlling the bleeding, the patient should be taken to the operating room, anesthetized and placed in the lithotomy position for inspection of the vaginal vault and for suturing. We have always been able to control the bleeding by resuturing the edges of the vaginal incision with figure-of-eight sutures through the vaginal approach. Conceivably, opening of the abdomen might be necessary if the hemorrhage originates in the uterine vessels. Of course, transfusions are used as necessary.

It is chiefly because of the possibility of late hemorrhage that we require abdominal and vaginal hysterectomized women to remain in the hospital for 14 days. We believe that this should be the rule whether or not early ambulation is practiced. This may be

an annoying and expensive price for many women to pay for the small percentage of women who bleed. Nevertheless, I am convinced that a few women upon whom I have operated owe their lives to the prompt action of the hospital staff when the bleeding has been so sudden and profuse that transporting the patient to the hospital might have resulted in irreversible shock.

### VAGINAL HYSTERECTOMY FOR THE MYOMATOUS UTERUS

Although the author of this volume was a "late comer" in the adoption of vaginal hysterectomy for the myomatous uterus, with greater experience I have become enthusiastic about its use in properly selected cases. The great ease and rapidity of recuperation of vaginal hysterectomy in contrast with laparotomy is of great advantage to the patient. Stoekel in Germany and Heaney in this country were great advocates of vaginal hysterectomy for fibroids even of considerable size. Several Viennese and French gynecologists were equally enthusiastic. For the small free myomatous uterus which can be delivered in toto, there can be little argument. Patients recuperate from the vaginal hysterectomy more rapidly than when the operation is done abdominally. Also, if vaginal plastic work is indicated there is great advantage in being able to do all the surgery through one field. A parous outlet is usually an advantage in vaginal hysterectomy, but nulliparity by no means excludes this approach. As a matter of fact, the vaginal removal of the uterus in the nulliparous woman can on certain occasions be easier than on the parous woman. The lack of scarring in the vaginal vault and the cardinal ligament regions in the woman who has never borne children may more than compensate for the smaller vagina. Descensus of the uterus is not a requisite for vaginal hysterectomy, although a certain degree of it certainly facilitates the procedure. The presence of a low abdominal scar indicating previous pelvic surgery should make one evaluate the case very carefully before approaching the hysterectomy vaginally. However, previous pelvic surgery does not absolutely exclude the vaginal approach. Recently, Ingram, Withers and Wright have expressed optimism on vaginal hysterectomy following

previous pelvic surgery, and it is their belief that the dangers of previous surgery have been overestimated. They report on 274 vaginal hysterectomies of whom 26 per cent had undergone previous pelvic surgery. In only 2 instances was it necessary to complete the operation abdominally. A careful examination under anesthesia in order to estimate the mobility of the uterus is important in those who have had previous pelvic surgery. We have removed many myomatous uteri vaginally that have felt free in spite of previous surgery.

The size of the tumor should be considered carefully. It is true that often very large free fibroid uteri have been removed vaginally quite successfully, but the possibility of trouble increases with the size of the uterus. It is always well to have a laparotomy table set up in the operating room when vaginal hysterectomy is done. Only once in my career have I been required to finish the operation abdominally, but on that occasion I believe it was lifesaving. If the fibroid uterus is too large to be delivered through the vaginal incision relatively easily, it is far safer to resort to morcellation than to struggle to deliver a large tumor. Morcellation should not be attempted until after the uterine vessels are ligated. If it is impossible to expose the uterine artery area, the operator had best give up the vaginal approach. In most instances morcellation is most easily done anteriorly, but occasionally it can be accomplished more readily through the cul-de-sac. After drawing the uterus out as far as possible, orangelike slices are taken in the uterus until the uterus has been so reduced in size that it can be delivered readily. Then the hysterectomy is completed. Often individual fibroids can be shelled out. The procedure of morcellation is usually surprisingly bloodless.

A history of abdominal pain is a relative contraindication to the removal of a fibroid uterus vaginally. Under such circumstances, exploration of the abdominal and pelvic cavities via a transabdominal route is preferable. Adnexal disease, especially salpingitis and endometriosis, contraindicates vaginal hysterectomy for fibroids. Occasionally, we have deliberately proceeded with vaginal hysterectomy in the known presence of a small

freely movable ovarian cyst, but in general adnexal disease is better approached abdominally.

The technic of vaginal hysterectomy is discussed in Chapter 7, "Prolapse of the Uterus."

### ABDOMINAL MYOMECTOMY

The earliest operation of myomectomy was done by Amussat in France in 1840. Howard A. Kelly, Charles P. Noble and the Mayos wrote about myomectomy and practiced it extensively in this country during the early part of the 20th century. Victor Bonney, of London, and Isidor Rubin, of New York, were among the most enthusiastic myomectomists of the recent generation. For example, Bonney removed 225 tumors from one uterus.

This enthusiasm for the removal of multiple fibroids greatly exceeds that of the author, although occasionally the performance of myomectomy for a large number of fibroids is indicated when the preservation of the uterus is of extreme importance to the patient.

A consideration of the indications, the contraindications and the technic follows:

### INDICATIONS AND CONTRAINDICATIONS

With few exceptions all indications and contraindications in medicine are relative, a fact that is especially true when one considers myomectomy versus hysteromyomectomy. It is difficult to lay down absolute criteria for the removal of, or the saving of, the uterus, but certain advantages and disadvantages of the two procedures will be discussed. It should be remembered that the only proved purpose of the uterus is childbearing, and while a few gynecologists have considered the endometrium to have an endocrine function, there is little real evidence to support such an idea; it has been abandoned by most gynecologists of today. The preservation of the function of menstruation is not important unless future childbearing is desired. Despite this, many women feel that the preservation of menstruation is essential to health, youth and sexual life. A simple explanation will convince many of them of their error, but no explanation will suffice to satisfy others. The possibility of removal of

the uterus should be discussed freely with the patient, for if the attitude of the patient is well understood by the surgeon he will be greatly aided in making his decision at the operating table. Full permission from the patient to do whatever is necessary is essential, so that the gynecologist may be free to exercise his best surgical judgment. Because of technical reasons, discoverable only at operation, it is often difficult to be sure before operation that myomectomy is possible or wise. Should the removal of the uterus become necessary in the woman who is very desirous of retaining it, she will feel more kindly to the surgeon and will have less difficulty in becoming mentally adjusted to its loss if she has been told previously of the possibility of losing it.

The greatest reason for considering myomectomy is the patient's desire for future childbearing. In general, the younger the patient the greater the role this plays, but there are important exceptions to this rule. A woman who, for one reason or another, has had to defer marriage or childbearing until her middle thirties may feel a stronger desire for children than some girls in the early twenties; the wish of such an individual should be respected. The problem actually presents itself more often at this time of life, as fibroids more commonly give rise to symptoms in the 4th decade than they do in the 3rd. During the years of World War II the author performed more myomectomies than in the rest of his career. The reason was the great increase in sterility work. Many women who had practiced contraception for years were suddenly confronted with the possibility of a prolonged absence of their husbands. Many of these women were in their thirties. They decided to attempt a pregnancy, and when they failed to become pregnant they consulted a gynecologist only to find that they had fibroids; often the tumors were of considerable size. In many of such women I have stretched the indications for myomectomy in the hope of permitting future pregnancy. It has occurred to me that Rubin's enthusiasm for myomectomy is probably based on the relative frequency of his discovery of fibroids in patients who consult him, not for the usual symptoms of fibroids but because of sterility. It is obviously impossible, for technical rea-

sons, to make a definite rule concerning myomectomy, but the more intense the desire of the woman for children the more one is justified in stretching the indications for myomectomy.

The twisting and/or the necrosis of a pedunculated fibroid during pregnancy is a special indication for myomectomy. Although such complications are rare, the performance of a successful myomectomy without interruption of the pregnancy is a surgical feat of supreme importance to the patient. Only when the patient experiences repeated attacks of acute pain, vomiting or fever should myomectomy be considered during pregnancy. Sedation should first be given an adequate trial. When myomectomy becomes a necessity most authors believe that it should be done after the 19th day of pregnancy, when the uterus is less irritable and placental function is well established. However, the time of the onset of the symptoms may not give the gynecologist the choice of selecting the time for operation.

In women in the early or middle thirties who desire children, the performance of myomectomy can be an essential part of the treatment of sterility or, in some instances, a desirable operation before permitting the patient to risk a pregnancy.

What are the chances of pregnancy following myomectomy? In Brown, Chamberlain and Te Linde's series there were 172 married women. All of these were followed for 2 or more years. Seventy-four, or 42.5 per cent, became pregnant, and 64 women delivered a total of 111 living children. Certainly, some of the myomectomized women practiced contraception, so it is probable that the 42.5 per cent is not a true index of the pregnancy potential. Occasionally, we have performed myomectomy primarily for the relief of sterility, and there were 21 patients in our series whose primary complaint was sterility, and myomectomy was the only treatment except for preoperative testing of tubal potency. Eleven of the 21 became pregnant. Nine went to term, and a total of 18 living children were born.

In our series there were 8 patients whose primary complaint was repeated abortions, and no other abnormality was found to account for this. Then the operations were

done for the relief of this, and all became pregnant following the surgery. However, only 4 went to term with living infants, the other 4 terminating in abortion, prematurity or still birth.

There are a few absolute contraindications to myomectomy. Malignancy of any type in the uterus or the ovaries excludes myomectomy. If the tubes are closed with certainty, or if they have been removed previously, there is no justification for myomectomy. Under such circumstances the retained uterus is useless; also, it is often a source of future trouble. Diffuse adenomyosis of the uterine wall involving an appreciable part of the myometrium, being unencapsulated, is removed completely with great uncertainty, and an attempt at local excision should not be made.

Myomectomy at term, in conjunction with a cesarean section, is rarely justified. If there is a *pedunculated subserous fibroid* attached to the uterus with a small pedicle, cutting and suturing of the pedicle may be done easily. The removal of intramural fibroids from the uterus at term is not advisable. Hesselstine and Huber showed that when only cesarean section was done on fibroid uteri at term the mortality was from 0 to 5.5. When cesarean section was done with hysterectomy, the mortality rate was from 1.4 to 3.4 per cent. When myomectomy was combined with cesarean section the death rate was from 12.2 to 14.3 per cent. The reason for the double figure in each instance is the fact that there was one death of a patient whose history was incomplete, and it was uncertain as to which group she belonged. In any case, the figures indicate a great increase in mortality when myomectomy is done.

Myomectomy is seldom justified in a woman over 35, and it is never a reasonable procedure when she is past 40. Only in those cases of late marriage in which childbearing is greatly desired should myomectomy be considered in the late thirties.

A uterus that is the site of a large number of fibroids had better be removed rather than subjected to multiple myomectomies. Rubin reports the removal of 33 myomas from one patient, and Victor Bonney has removed 225 fibroids from a single uterus. It is difficult for us to believe that the removal of such a

large number of fibroids is ever justifiable; a uterus that is the site of many visible fibroids usually contains many invisible seed tumors that will eventually give trouble. Perhaps the possibility of an heir to a throne might justify a procedure such as described above, but it would hardly seem good surgical judgment under ordinary circumstances. Furthermore, such a multiscarred uterus would be a poor receptacle in which to carry the fetus to term, and a still poorer organ to carry on the function of labor.

Race is an important factor in making the decision for myomectomy or hysterectomy. Because of the great tendency of the colored race to multiple fibroids we rarely practice myomectomy on the uterus of a colored woman. The possibility of future tumor formation is too great to justify the preservation of the uterus, although in rare instances, when the abdomen has been opened for other conditions, we remove small incidental myomata, thus preserving the uterus.

When myomectomy is considered, its technical difficulties and increased operative risk over hysterectomy always must be evaluated. In most cases myomectomy is a more difficult operation than hysterectomy except when the subserous tumor is pedunculated or the intramural fibroid is small. In recent years the mortality for the operation at the Mt. Sinai Hospital was 1.9 per cent. Although many series of hysteromyomectomies are reported with a mortality equal to this or even greater, hysterectomy is done in most of the better clinics today with a mortality of less than 1 per cent. Brown, Chamberlain and Te Linde had no mortality in 329 myomectomies on nonpregnant women and 1 death among 16 pregnant women. This woman had a gas-bacillus peritonitis preoperatively with a twisted pedunculated fibroid, and the operation was undertaken as a desperate emergency measure. If a surgeon uses reasonable judgment in selecting his cases, I believe it can be said that myomectomy carries no more mortality than a hysterectomy.

When considering myomectomy the patient wishes to know the possibility of further surgery, and it is well to have definite facts to give her. Brown, Chamberlain and Te Linde followed 234 myomectomy cases for 2 or more years. In 18.6 per cent myomas

recurred, but in only 10.3 per cent was a hysterectomy required. Of course, the longer the cases are followed the more recurrences there will be. Of the 176 cases followed for 5 or more years 31.3 per cent had recurrent fibroids, and hysterectomy became necessary for these fibroids in 16.5 per cent. Hysterectomy became necessary for other causes in an additional 4.3 per cent. Thus, over 20 per cent of the women on whom myomectomy was done required a later hysterectomy.

There remains the problem of the method of delivery after myomectomy. We have

never had a case of rupture of the uterus after a myomectomy at the Johns Hopkins. It is my belief that the obstetricians are excessively cautious in not letting more of these women deliver vaginally. However, in defense of their attitude one must remember that many of these women are elderly for childbirth, and that this may be their last chance at childbearing. In our series, 120 women were delivered vaginally, and 24 by cesarean section. The rule has been to perform cesarean section if the uterine cavity had been entered at the time of myomec-

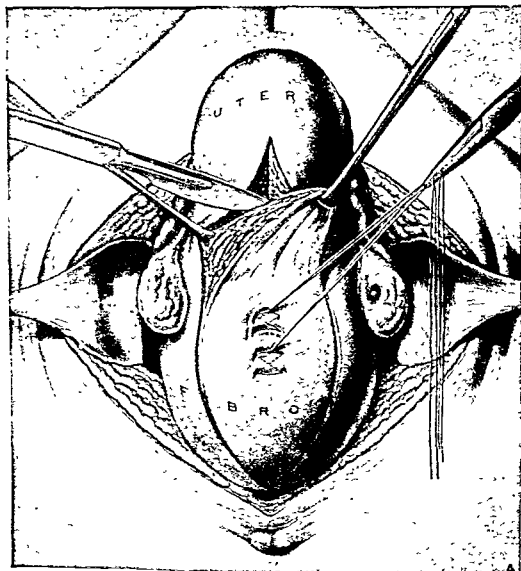


FIG. 156. Abdominal myomectomy for large intramural fibroid. (A) Figure-of-eight sutures of No. 2 chromic catgut have been placed through the tumor for traction. The tumor is being excised with sharp dissection.

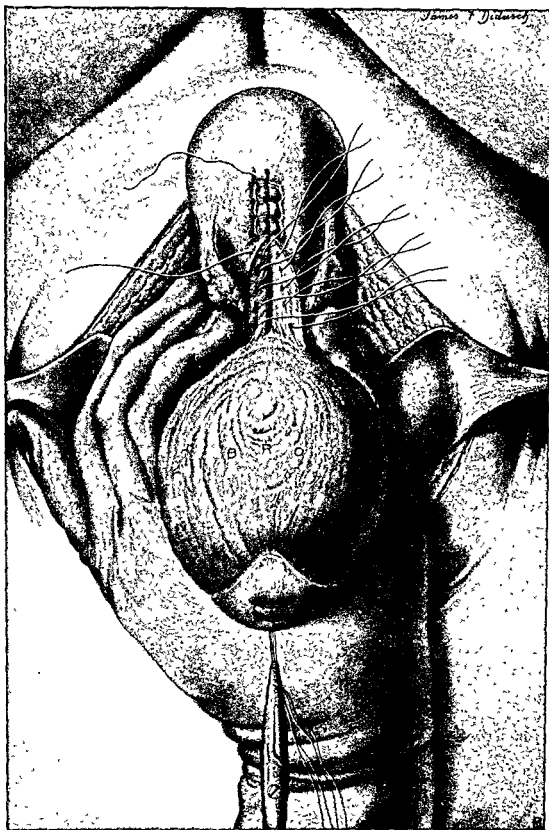


FIG. 156 (Continued). Abdominal myomectomy for large intramural fibroid. (B) Much blood loss is prevented by compressing the sides of the uterus. Excess of serosa has been excised, and myometrium is sutured with interrupted No. 0 chromic sutures as the tumor is excised.

tomy or if there was reason to believe by the postoperative course that the myomectomy wound was infected. Although this may be an excessively cautious attitude, it appears to be a safe one.

#### TECHNIC: ABDOMINAL MYOMECTOMY

Figure 156 illustrates a rather typical myomectomy for a large, single, intramural fibroid. An elliptical incision is made through the serosa over the tumor. This incision

should represent an underestimate of the amount of serosa that is to be removed, for more can be trimmed off after the tumor is removed, whereas too radical excision of the serosa would be rather difficult of closure. The tumor is shelled out by a combination of sharp and dull dissection (Fig. 156 A). The knife handle is an excellent blunt dissector for this procedure. Often figure-of-eight traction sutures placed in the tumor afford convenient traction while enucleating

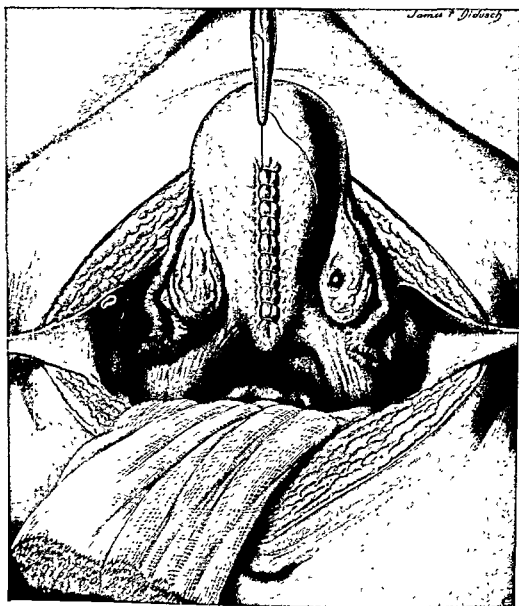


FIG. 156 (Continued). Abdominal myomectomy for a large intramural fibroid. (C) Approximation of serosa with continuous suture of No. 0 chromic catgut.



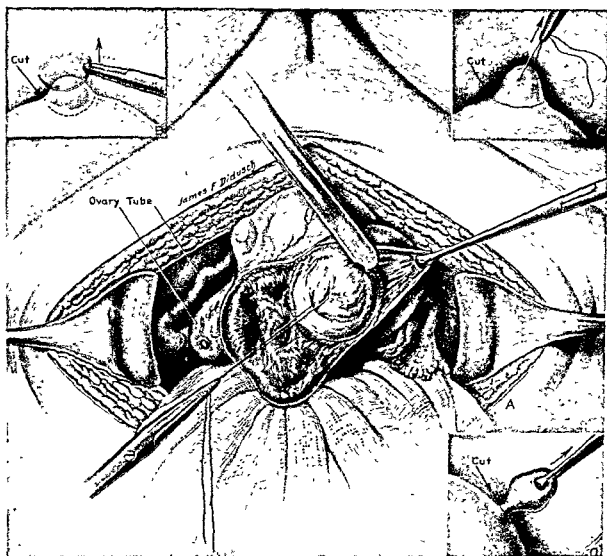


FIG. 157. Technical steps in myomectomy. (A) Multiple myomectomies through a single incision. Two myomas have already been enucleated, and dead space has been approximated with interrupted catgut sutures. A third is being enucleated. (B) An empty curved needle is a convenient instrument for grasping a small fibroid as it is enucleated. (C) A traction suture may serve equally well. (D) The simplest myomectomy for small pedunculated tumor.

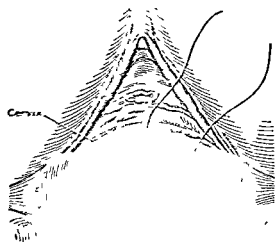
the tumor. Often bleeding can be controlled to a large extent by pressure with the left hand (Fig. 156 B). Another excellent means of conserving blood loss is the suturing of the myometrium with interrupted or figure-of-eight sutures of No. 0 chromic catgut as the enucleation is done (Fig. 156 B). If the entire enucleation is done before suturing the myometrium and if the tumor is large, bleeding may get out of control. The sutures in the myometrium, if left long, also serve as convenient traction sutures. After the myometrium has been approximated by one or

more layers of sutures and the bleeding well controlled, the serosa is closed with a lock stitch of No. 0 chromic catgut (Fig. 156 C). A fine needle should be used for the serosal stitch; a nontraumatic needle is excellent.

When multiple myomectomy is necessary for fibroids in close proximity, frequently several tumors can be enucleated from one incision. In Figure 157 A two fibroids have already been enucleated, and the third is being shelled out with the knife handle. Figure 157 B shows a convenient method of holding a small subserous fibroid for



FIG. 158. A tourniquet has been placed around the cervix to reduce bleeding during myomectomy.



enucleation. Figure 157 C shows traction suture in small fibroid used for this purpose. Figure 157 D represents the simplest form of myomectomy for a small subserous pedunculated tumor. One figure-of-eight suture usually controls bleeding after such an excision.

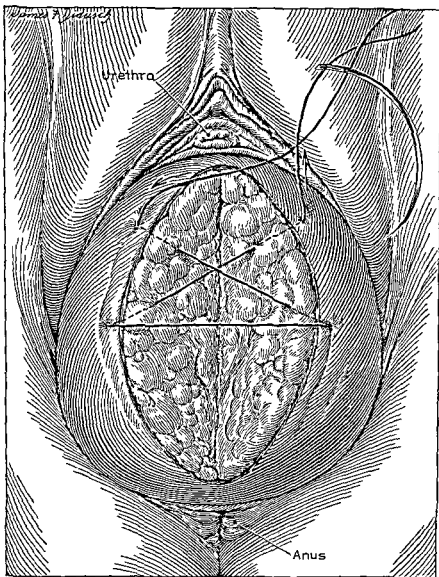
When an extensive myomectomy for large fibroids is to be done, bleeding often can be reduced by the use of a tourniquet placed about the uterus just above the level where the uterine vessels approach the side of the uterus (Fig. 158) and rubber shod clamps on the ovarian vessels.

### VAGINAL MYOMECTOMY

The removal of a pedunculated submucous fibroid that has worked its way down through the cervical canal and into the vagina is best accomplished by the vaginal route. Such fibroids are always infected and, in general, the removal with the least manipulation is the best. When a submucous fibroid just "peeks" above the external os, the cervix can be closed by suture and a total abdominal hysterectomy done immediately.

If the myoma is not too large and is pedunculated, the pedicle is transfixed with a suture of chromic catgut at the highest possible point before cutting of the

FIG. 160. Vaginal myomectomy by morcellation. A wedge-shaped piece of the myoma has been excised. A gross figure-of-eight suture is placed to control bleeding temporarily and to make traction.



pedicle (Fig. 159). If the pedicle is so high in the cervical canal that it is impossible to transfix it, often it may be cut with the actual cautery at a low heat or with the electro-surgical knife with a combination cutting and coagulating current. We never have seen serious hemorrhage result from such cutting of the unligated pedicle. Frequently, the vessels in the pedicle are thrombosed. If bleeding should occur it can be controlled easily by ligating the pedicle after removal of the tumor or, if this is impossible, by packing.

When the submucous myoma is very large and fills the vagina so completely that the pedicle cannot be reached, it may have to be removed piecemeal. It is our practice to make wedge-shaped incisions in the tumor, re-

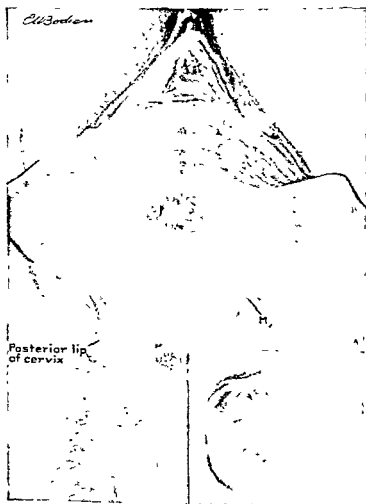
ducing its size until sufficient room is afforded to permit access to the pedicle. Bleeding is controlled by grasping and compressing the remaining portions of the tumor or by temporarily suturing them (Fig. 160). Often there is surprisingly little bleeding when such tumors are cut into. Occasionally, one will discover a tremendous dilatation of the cervix with a huge tumor coming from it with no sign of a pedicle. Such tumors may be cut flush with the cervix, using the cautery or combination coagulating-and-cutting electro-surgical current. If this does not control bleeding satisfactorily a tight vaginal packing with sulfanilamide-impregnated gauze may be used. Relieved of the pull of the portion of the tumor that has been removed,

the remainder of the tumor often retracts up into the uterine cavity. At a later date the cervical lips may be sutured together and a total abdominal hysterectomy done. Before removing an infected submucous myoma the patient should be treated with penicillin and streptomycin, and these antibiotics should be continued for at least 2 days after the operation.

#### VAGINAL MYOMECTOMY FOR CERVICAL MYOMA

Cervical myomata arising from the portio are generally discovered before they attain

such size that hysterectomy is required, as described earlier in this chapter. Figure 161 shows a cervical myoma that has arisen from the anterior lip of the portio. Its abundant blood supply was easily visualized as shown in the picture. Figure-of-eight sutures of No. 1 chromic catgut were first placed on either side of the anterior lip but were not tied until the tumor was excised with a wedged-shape piece of cervical lip. Then the sutures were tied. This controlled bleeding satisfactorily. Next, the 2 suture ends were tied together; this neatly approximated the cut edges of the anterior lip.



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# Operative Injury of the Ureters

## CAUSES

Operative injury to the ureters occurs very rarely during pelvic surgery in the better clinics, but occasionally even the best of surgeons may injure a ureter. The incidence of accidental ureteral ligation is difficult to determine with certainty, for there is no doubt that following a ureteral ligation at times the kidney may quietly cease to function; the patient or the surgeon never may become aware of the accident, but usually the outcome is not so happy. Ureteral injury occurs most often during hysterectomy—abdominal or vaginal—but it is about 6 times as frequent in the abdominal as in the vaginal. The accident may occur in other pelvic operations, such as the removal of a tubo-ovarian abscess or an adherent ovarian neoplasm. The Wertheim type of radical pan-hysterectomy for cervical carcinoma has contributed most heavily to ureteral injury. The dissection of the ureter required in this operation as originally done resulted in a high percentage of injury, even when performed by an expert; Wertheim himself reported an incidence of 10 per cent. Since the operation has been generally abandoned in this country in favor of radium therapy, ureteral injuries have decreased markedly. Recently, Meigs has revived interest in the Wertheim type of operation for cervical cancer; although he reported a series of 85 cases with no deaths, there still resulted an incidence of ureteral fistulae of 7.2 per cent. In our own clinic there were 31 ureteral injuries occurring in 15,100 pelvic operations: 12,500 of these were abdominal procedures, and 3,600 vaginal operations, including 500 vaginal hysterectomies. The accident is a serious one with a relatively high mortality, as is evidenced by Bland in

his report of 18.8 per cent for unilateral and 33.3 per cent for bilateral injuries.

Like all surgical accidents, prevention is better than cure; hence, a consideration from this point of view deserves our attention. The injury usually occurs in one of four places: at the infundibulopelvic ligament, in the region of the uterine vessels, at any place between these two points where an inflammatory or neoplastic mass may be adherent to it, or where the ureter lies between the anterior vaginal wall and the base of the bladder (Fig. 162). The first of these places is the least frequent site of injury, but occasionally, when there is a short infundibulopelvic ligament due to distortion of the normal anatomy by a large ovarian or parovarian cyst or a large tubo-ovarian abscess, the clamp placed on the ovarian vessels may include the ureter. The second region, that of the uterine vessels, is the most common site of injury. If the uterine vessels are clamped carefully close to the uterus and tied with precision and care the danger of ureteral injury is reduced markedly. The greatest danger of injury to the ureter is experienced in those cases in which the vessels slip from the clamps or the ligatures, and reclamping is attempted quickly and in the presence of profuse bleeding. Not infrequently, with large pelvic tumors, especially those that have developed between the leaves of the broad ligament, freeing of the tumor from the pelvic wall may endanger the ureter; identification and exposure of the ureter are necessary. When ureteral identification is desirable it is well not to dissect it free from its bed for any greater distance than is necessary and also to leave as much periureteral tissue as possible attached to the ureter, for in this tissue lie important blood vessels that

supply the ureter. Most of the fistulas that occur following the Wertheim panhysterectomy for carcinoma result from sloughing due to interference with blood supply rather than to direct injury of the ureter by the operator. It is well recognized that irradiation preceding the Wertheim operation greatly increases the danger of sloughing of the ureter. The irradiation, causing fibrosis of the nutrient vessels of the ureter, reduces the blood supply, and the surgical dissection often robs the ureter of the remainder. Also, in the radical total abdominal hysterectomy, as it is done in this clinic for Stage 0 cervical cancer, identification of the ureter for some distance

along its course is essential for safety. In such cases, preoperative catheterization of the ureters is advisable. Also, when an intraligamentary fibroid, an adherent ovarian cyst or bad pelvic inflammatory disease suggests proximity or adhescence to a ureter, preoperative catheterization is time-saving and a great safety factor. By this procedure, not only can the ureter be identified more easily and speedily, but its course can be followed for as great a distance as is required without its complete dissection and without the attendant danger to its blood supply. Although the value of this safeguard is belittled by some surgeons who believe that they can

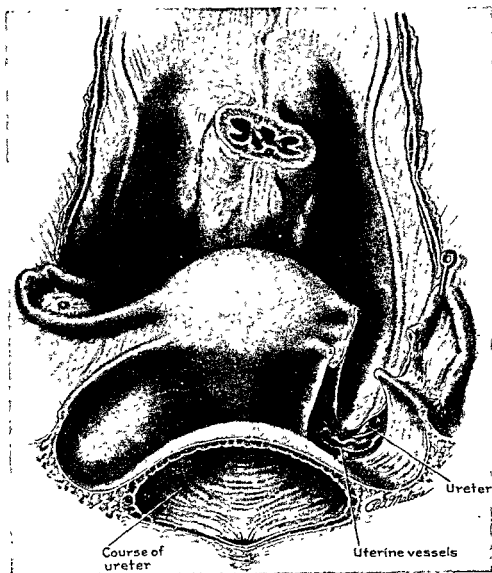


FIG. 162. Dissection showing relation of ureters to pelvic viscera.

locate the ureter at will, often we have seen experienced surgeons waste as much as a half hour in identifying the ureter. The saving of operating time in the course of a prolonged operation surely is well worth consideration. It is also the belief of some surgeons that *ureteral catheterization increases the danger of ureteral fistulas*, basing their claim upon their experience with the Wertheim operation for cervical cancer. It would appear to us that the stripping of the ureter for a long stretch and thus endangering the blood supply is the real factor concerned in the formation of these fistulas. In any event, we never have experienced a ureteral fistula following our radical panhysterectomy, without lymph node dissection, which we perform in this clinic for cervical cancer in situ. In performing less radical total abdominal hysterectomy for benign uterine disease avoidance of injury to the ureter anterior to the vagina can be accomplished by adhering to the Richardson technic, described elsewhere in this volume. Regardless of the particular technic used in total abdominal hysterectomy, care should be taken to dissect the bladder well down on the vaginal wall before the cervix is cut from the vagina and to note carefully what is included in each stitch as the vagina is sutured.

### TREATMENT OF OPERATIVE URETERAL INJURIES

The treatment of ureteral injuries should be considered in the two groups into which they naturally fall: those recognized at the operating table and those discovered subsequently.

#### Injuries Recognized at the Operation.

When a clamp or a ligature is discovered on a ureter *during the course of an operation* it should be removed immediately, and the ureter should be inspected carefully. In many instances insufficient damage will have been done to prevent normal function of the ureter. If the damage is slight but the operator feels uneasy about its condition, a stab wound may be made and a cigarette drain placed extraperitoneally adjacent to the injury site as a safety valve. The peritoneum should be closed over this so that if there is leakage it will be extraperitoneal. If the operator feels

uneasy about simple drainage, a longitudinal slit may be made in the ureter above the injury and a polyethylene tube of suitable size threaded down the course of the ureter, left coiled in the bladder, and removed after 10 days. Obviously, there is room for judgment as to the seriousness of the damage. If the ureter is discovered to be cut, or if there is damage that makes it appear incapable of spontaneous restoration, the operator has 3 choices. He may implant the severed ureter into the bladder, perform a uretero-ureteral anastomosis, or he may simply ligate the upper segment of the ureter. The ideal repair should preserve normal kidney function and restore the function of the ureter. Implantation of the ureter into the bladder offers a closer approach to this ideal than uretero-ureteral anastomosis. Hence, if the injury to the ureter is sufficiently low to permit it, implantation into the bladder is the preferred procedure. If the injury is too high for this, uretero-ureteral anastomosis should be attempted. There are in our opinion only two occasions on which simple ligation of the injured ureter is justifiable: (1) when the operation has been of such magnitude that prolongation sufficient to perform an implantation or anastomosis would seriously risk the patient's life; (2) when a considerable section of the ureter has been removed, making impossible implantation or anastomosis. Before deliberate ligation is done one should palpate the opposite kidney to determine its presence and, as far as possible, its normal condition. Experience has shown that ligation when the urine is uninfected usually results in an asymptomatic, afunctional kidney. Ligation of the ureter under these circumstances should be done with a strong nonabsorbable material. If palpation reveals absence of the opposite kidney or any evidence of abnormality the proximal end of the ureter should be brought out to the skin and permitted to drain until the condition of the opposite kidney can be determined.

*Bilateral cutting or severe damage of the ureters is rare, and still more rare is its discovery at the operating table.* When one is confronted with such a serious accident at the operation, bilateral anastomosis or implantation must be done. In case the patient's condition does not permit repair on both



sides, one must be repaired and the opposite ureter brought out to the skin to permit functioning of that kidney until it can be determined that the repaired ureter is working satisfactorily.

**Injuries Undiscovered at the Operation.** *Bilateral ligation* soon becomes apparent as anuria results. For the first 48 hours this is usually the only symptom, but soon thereafter the nonprotein nitrogen of the blood begins to rise, and the patient shows signs of uremia. If the obstructions are unrelieved, death usually results within from 7 to 10 days. If no evidence of serious kidney disease was discovered in the preoperative urinalysis, one can be quite certain that anuria for 48 hours postoperatively signifies bilateral ureteral injury. Before resorting to surgery it is our custom to attempt passing ureteral catheters to demonstrate definitely the ureteral obstructions or, as is rarely possible, to overcome one or both of the obstructions. When one is certain that the condition exists, the sooner treatment is instituted the better. We feel strongly that bilateral nephrostomy is preferable to attempting deligation. In attempting transabdominal deligation one is subjecting a patient who has had a laparotomy a few days previous to a second one, and the mortality is high. The technical difficulties of working in the ureteral regions, which so recently were subjected to operative trauma, are great, and the deligations may be unsuccessful. In contrast with this, bilateral nephrostomy is done quickly, the patient soon begins to pour forth quantities of urine, and the blood nonprotein nitrogen drops rapidly. Urinary secretion is immediately stimulated postoperatively by intravenous injections of glucose and saline solution. Occasionally, the ureteral lumina will re-establish themselves spontaneously after nephrostomy or pyelostomy. If they do not, an attempt may be made to open the ureters by ureteral catheterization, although such attempts often fail. If ureteral catheterization fails to overcome the obstruction, a laparotomy should be performed 6 weeks after the nephrostomies, and the necessary ureteral plastic work should be done. The condition of the patient is then sufficiently good to permit meticulous painstaking work which is necessary to give permanent normal ureteral function.

*Unilateral ureteral injury which is unrecognized at the operation* may become apparent later by: (1) symptoms of pyelitis; (2) evidence of ureterovaginal or ureterocervicovaginal fistula; (3) the appearance of a mass in the kidney region due to hydronephrosis. As previously stated, complete and permanent occlusion of one ureter in the absence of infection sometimes leads to renal atrophy without symptoms, local or constitutional. The appearance of chills and fever, postoperatively, may indicate a simple acute postoperative pyelitis, but when these symptoms persist under the usual medical therapy the possibility of ureteral injury should be considered. Ureteral catheterization will determine whether or not the ureter has been occluded. It is possible, but not likely, that the obstruction can be overcome with the ureteral catheter. If one is fortunate enough to overcome the obstruction, the catheter should be left in the ureter for several days to permit drainage of the kidney and healing of the injured ureter. If the obstruction cannot be overcome and the symptoms of pyelonephritis are present, a nephrostomy should be done at once to permit drainage of the infected urine and preserve the kidney substance until some weeks have passed when the patient's local and general condition are such as to ensure success in the necessary work on the injured ureter.

At times, the appearance of urine in the vagina gives the first intimation of ureteral injury. If there has been cutting of the ureter without ligation, the urine may appear almost immediately postoperatively. Since most ureters which are cut at operation are also ligated, several days may elapse before the ligature sloughs off and permits drainage. Since most ureteral damage today is the result of stripping the ureter of its blood supply as in the Wertheim operation, several days elapse before sloughing has progressed to the point of permitting urinary drainage. In our experience the vaginal drainage usually becomes evident in such cases from the 10th to the 21st postoperative day. After total hysterectomy this enters the vagina directly via a fistulous tract from the ureter. Following subtotal hysterectomy, the urine usually enters the vagina via the cervical canal. In other cases the appearance of the fistula may



FIG. 163. Urogram showing effect of ureteral injury at Wertheim operation. After 3 weeks the kidney still shows considerable function but has developed a marked hydronephrosis.

be preceded by an attack of pyelitis; then the drainage afforded by the fistula may result in subsidence of the temperature. In other cases the evidence of pyelitis may appear after the evidence of fistula formation, for there is a tendency for all fistulous openings to contract, this leads to ureteral obstruction and pyelitis. Occasionally, the fistula may close spontaneously with re-establishment of the ureteral lumen, and because of this a reasonable period of expectant treatment is permissible. If the policy of watchful waiting is pursued for several weeks, intravenous urograms should be done repeatedly to note the effect on the kidney (Fig. 163). If hydronephrosis is observed to be developing, nephrostomy or the plastic work on the ureter should be done without delay. The choice of these two procedures depends upon the local condition and also the general condition of the patient. The spontaneous cessation of drainage through the vagina may

mean infrequently a diversion of the urine elsewhere, as into the peritoneal cavity; this has been reported by Hunner and Everett.

As the hydronephrosis develops, judgment is required as to when to take the next step. If there is spiking fever, nephrostomy or pyelostomy should not be delayed. If the hydronephrotic kidney is uninfected, usually one may wait as long as 6 weeks before attempting surgery on the ureter, but one may vary this time, depending on the extent of the previous surgery in the region of the ureter and on the rapidity with which the hydronephrosis appears to be developing.

One of the first studies indicated after the appearance of urine in the vagina should be an attempt to prove whether the urinary fistula communicates with the bladder or the ureter. A convenient way to do this is to fill the bladder with a weak solution of methylene blue and place a gauze sponge in the vagina; if the vaginal sponge remains free of methylene blue, the evidence points to the ureteral fistula. Inspection of the vaginal vault gives no information as to the side on which the ureter is damaged. Usually, the fistula can be located exactly by the passage of a ureteral catheter on the suspected side. As a rule, it is impossible to force the catheter past the point of injury because of scarring and stricture formation. If by good fortune the catheter is made to pass the injured point in the ureter, it should be left in for several days, during which time the fistula usually will heal. Before undertaking the operation for repair or implantation of the ureter a differential phthalein test should be done with the opposite ureter catheterized to determine beyond question the function of the kidney on the uninjured side. The output from the fistula may be caught in a bedpan. A knowledge of the function of the opposite kidney is invaluable to the surgeon when making his decisions while attempting to repair or reimplant the injured ureter.

Only when the final operation is undertaken can one decide on the exact procedure, and that must be done after investigating the local conditions from within the abdomen.

We have been able, on one occasion, to re-establish the ureteral lumen by simply opening the ureter longitudinally above the

acquired stricture, tunneling through the occluded segment and allowing the catheter to stay in place for several days. Retrograde pyelograms done on this patient a year afterward showed that little permanent damage had been done to the kidneys (Fig. 164). Kidney function was normal on both sides. If the injury is at the level of the uterine vessels or below, vesical implantation is usually

preferable to anastomosis. In some instances when the shortened ureter will not quite reach the bladder, the bladder may be elongated by rolling up a flap. The blood supply of the bladder is so abundant that generally this can be accomplished without fear of sloughing.

When a hydronephrotic kidney mass makes its appearance several months or years after the operation, and ureteral catheterization



FIG. 164. Intravenous urogram taken several months after bilateral plastic operation on ureters, following bilateral ligation.

indicates a complete ureteral obstruction, a nephrectomy may be necessary, but if the hydronephrotic sac is asymptomatic it may be left undisturbed.

#### TECHNIC: URETERO-URETERAL ANASTOMOSIS

The anastomosis may be done at the time of injury at the original operation or subsequently. If done at the time of injury a ureteral catheter, preferably a No. 7 or No. 8, is threaded up the upper segment and down the lower segment into the bladder, where it is permitted to curl up as shown in Figure 165.

If the anastomosis is done at some time subsequent to the original injury, the patient is first cystoscoped, and a catheter is passed up the ureter until it meets the obstruction. This enables the operator to identify the lower segment of the ureter easily. In view of the relatively recent operation, postoperative edema and changes in the tissues may make the identification of the ureter difficult without the aid of the catheter. The ureter is opened at the site of injury, and polyethylene tubing is passed up to the kidney pelvis. The other end of the polyethylene is fitted onto the tip of the catheter, and the catheter is

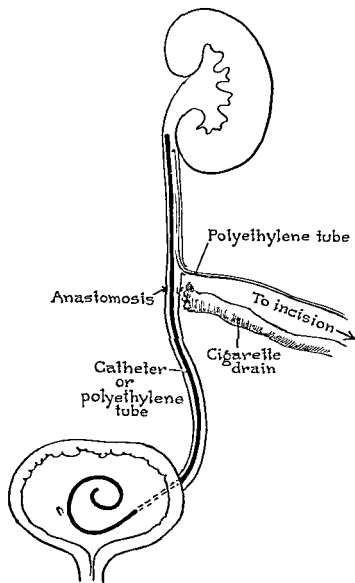


FIG. 165. Diagram showing anastomosed ureter. A catheter of polyethylene tube has been threaded up to the kidney pelvis and down into the bladder. A smaller polyethylene tube is inserted into the upper segment of the ureter through a slit-like incision about 1 cm. above the anastomosis. One cigarette drain is placed down to the site of the anastomosis.

withdrawn from the urethra by our assistant. Formerly, we used ureteral catheters, but the lumen of polyethylene tubing is much larger in proportion to the total diameter of the

tube; we now prefer this plastic tubing.

The ureter having been thus splinted by the polyethylene tubing, the two ends are drawn together and united by 3 or 4 inter-

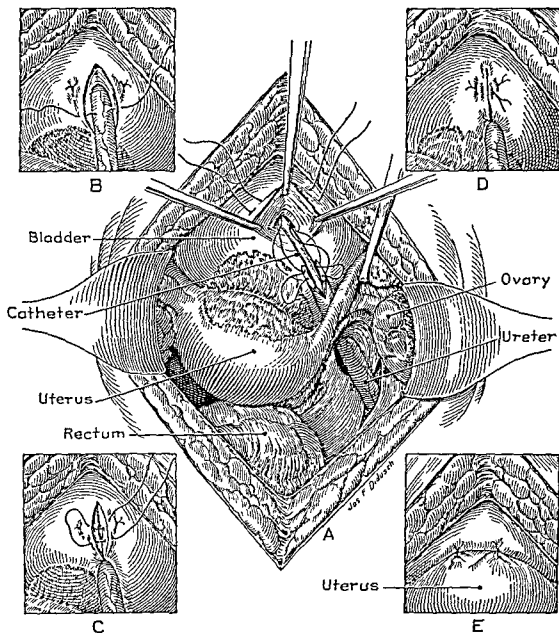


FIG. 166. Implantation of the ureter into the bladder. (A) The ureter has been dissected free and cut across. An opening has been made through the broad ligament into the bladder, and the end of the catheter has been introduced into it. Mattress sutures have been placed in the end of the ureter, passed into the bladder and out through the wall of the bladder. (B) Mattress sutures have been tied, and a fixation suture has been placed through the bladder wall and the muscular coat of the ureter. (C) The bladder-wall incision is approximated with a mattress stitch. (D) This mattress stitch has been tied, and implantation has been completed. (E) The uterus and the serosal surface of the bladder are sutured together to relieve any tension that might develop at anastomosis.



FIG. 167. (Left) Urogram taken 2 weeks after operative injury to left ureter. Hydro-nephrosis is developing, but the patient is still draining urine from the vagina. Ureter was reimplanted 6 weeks after injury. (Right) Urogram taken 5 weeks after implantation of injured left ureter into bladder, showing ultimate result. Note how the bladder was pulled up to meet the shortened ureter.

rupted sutures of No. 000 chromic catgut, placed through the outer coats of the ureter (Fig. 165). Before the abdomen is closed, drainage is established extraperitoneally, using a cigarette drain through a small stab wound. This drain is easily placed, under direct vision, to a point near the site of anastomosis. Then the peritoneum is closed over the ureter. If, during the postoperative course, there is any reason to believe that drainage from the ureter is not going well, the end of the tubing can be brought out through the urethra and irrigated.

The above-described technic is suitable in the usual case, but there is a special precaution which may be taken when, due to the condition of the ureter, it is feared that the anastomosis is not as satisfactory as one might desire. In such a case, urinary leakage at the

anastomosis might seem likely, and it might be desirable to leave the indwelling ureteral tubing in place for more than the usual 10 days. The urine may be diverted by making a short longitudinal slit in the ureter a short distance above the anastomosis and a small polyethylene tube threaded up toward the kidney pelvis, bringing the other end out through the incision. This has the added advantage of permitting irrigation and being certain of drainage without bringing the end of the indwelling catheter out through the urethra. This is demonstrated in the diagram shown in Figure 165.

#### TECHNIC: IMPLANTATION OF THE URETER INTO THE BLADDER

The ureter is dissected free from its bed for a sufficient distance to permit its implan-

tation into the bladder without tension. Since most ureteral injuries follow hysterectomy, the uterus is out of the way, and usually the bladder can be brought up to the shortened ureter if the ureter cannot be brought down to the bladder in its usual position. There is no advantage in performing the implantation retroperitoneally; hence, the implantation is usually done in the vertex of the bladder. The ureteral injury for which the implantation here pictured was done followed an anterior colpotomy for drainage of an abscess; hence, the presence of the uterus makes the implantation somewhat more difficult. The shortest route to the bladder was through an opening made in the broad ligament.

The lower end of the ureter is split for about 5 mm., and a substantial bite is taken into each part of the divided end, using No. 00 chromic catgut. A catheter is threaded up the ureter for several centimeters. An opening is made into the bladder at the point selected for the implantation. The edges of the opening are held with mucosa clips, and the end of the catheter is introduced into the bladder. The 2 sutures that were previously placed in the lower end of the ureter are then rethreaded and, with a fairly large round needle, they are introduced into the bladder and carried out through the wall, as shown in Figure 166 A. The sutures are carried out on opposite sides of the incision so as to hold

apart the slit ends of the ureter (Fig. 166 A). These sutures are tied, as shown in Figure 151 B, thus drawing the ureter into the bladder. A third stitch is taken to fix the ureter to the bladder wall. This stitch passes through the edges of the incision in the bladder wall and picks up the wall of the ureter (Fig. 166 B). A mattress suture is used to complete the closure of the bladder wall (Fig. 166 C and D). Finally, in this particular case the uterus is sutured to the bladder to cover over the raw area caused by separation of the bladder from the uterus to which it had been adherent. Pulling the bladder toward the uterus by these stitches also relieves tension on the anastomosis and fixes the structures in position for healing (Fig. 167).

Preceding a planned anastomosis, it is well to insert a ureteral catheter through the urethra and leave it coiled in the bladder. The polyethylene tubing used for splinting the anastomosis is threaded onto the tip of this catheter, and the catheter is withdrawn from the urethra. The tubing is strapped to a Foley catheter, and the Foley is strapped to the patient's thigh. The tube is removed in 10 days, and the Foley is left in the bladder for another day or two. During the 10 days the tubing is irrigated only if it fails to drain freely, and then only a few ccs. of sterile saline is used. The lower end of the catheter is left coiled in the bladder and is removed cystoscopically on the 10th postoperative day.

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# Surgery of the Double Uterus

## INDICATIONS FOR SURGERY

Surgery upon the double uterus (Fig. 168) may be required for a variety of symptoms or complications resulting from the congenital abnormality. Undoubtedly, the operation was done in the past on many occasions without proper indications. Ruge, in 1882, first reported the excision of a uterine septum in a woman who had had 2 abortions. She subsequently carried to term. The strongest advocate of the plastic operation was Paul Strassmann, of Berlin, who first unified a

bicornate uterus through the anterior cul-de-sac in 1907. He subsequently performed 17 unifications. His son, Erwin Strassmann, has continued interest in the operation and has collected 123 such operations carried out over the past 70 years. The indications for which these operations were done were habitual abortion, dysmenorrhea, menometrorrhagia, sterility, dyspareunia and premature delivery. It is obvious that many of these conditions would not be considered proper indications for the operation today. The surgical procedures used for the unification

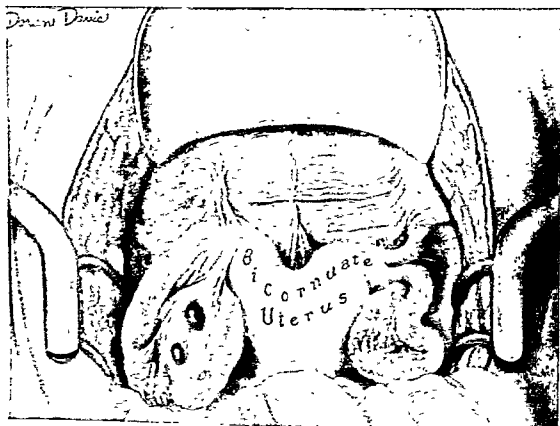


Fig. 168. Typical bicornuate uterus.



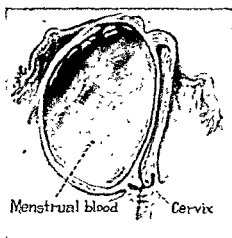
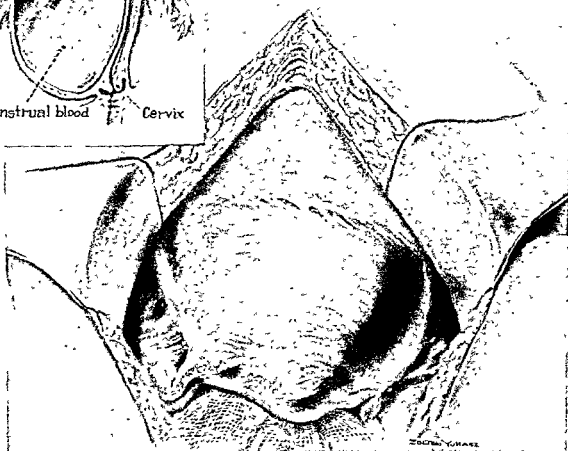


FIG. 169 A. Bicornuate uterus as seen at operation. The inset shows hematometra in the uterine cavity which does not communicate with the other cavity or the cervical canal.



described here differ in an important detail from the Strassmann procedure. In the latter, the uterine incision is transverse from cornu to cornu across the uterine fundus with the final suture line in the anteroposterior mid-plane of the uterus. Such a procedure incises rather than excises the septum. The operation herein reported attempts to excise the muscular septum by a triangular incision, resulting in a final vertical mid-line incision. This has the additional advantage of avoiding injury to the cornua.

Although there are perhaps other indications, we have found the following indications requiring surgery on the double uterus:

1. Hematometra occurring in a rudimentary horn or in a completely septate uterus in which one uterine cavity does not communicate with the other cavity or the cervical canal.

2. Pyometra occurring in one or both horns, resulting from infection in the cavity from which drainage is inadequate.

3. Habitual abortions, occurring as a result of the congenital abnormality, after excluding endocrine or metabolic disturbances which might account for the abortions.

## SURGERY FOR HEMATOMETRA

Operation for hematometra for a noncommunicating rudimentary uterus consists of excision of the rudimentary uterus and adnexa. Figure 290, shown in Chapter 27, "Endometriosis," shows such a case encountered at the Mayo Clinic. The retention of menstrual blood resulted in hematometra, hematosalpinx and unilateral pelvic endometriosis. The rudimentary uterus and the unilateral adnexa were excised by Counsellor,



FIG. 169 B. The septum has been excised, and anastomosis is being made, uniting the two cavities.



FIG. 169 C. Anastomosis is completed. The small incision in the left uterine cavity was made before the septum was removed for the purpose of orientation.

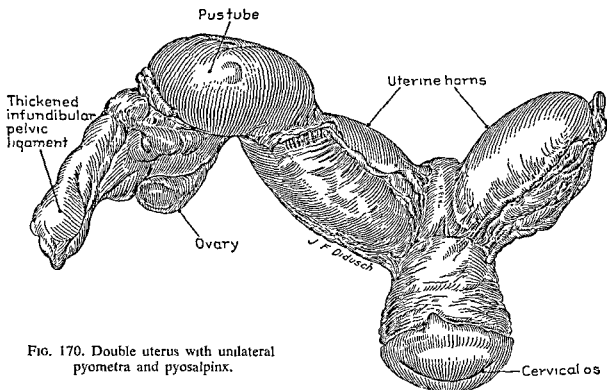


FIG. 170. Double uterus with unilateral pyometra and pyosalpinx.

and subsequently the patient was delivered of a full-term child.

A rarer condition is the one shown in Figure 169 A, in which a bicornate uterus was associated with a complete septum. One cavity failed to communicate with the other uterine cavity or the cervical canal. The patient complained of incapacitating dysmenorrhea, which lasted for 5 days, and a tense cystic mass was palpable in the right half of the pelvis.

Operation consisted of making an incision through the anterior wall of the cystic right portion of the uterus. It was found to contain old menstrual blood. The entire septum was excised, and the uterus was reconstructed by anastomosis of the two cavities. A continuous lock stitch joining endometrium to endometrium was reinforced by interrupted myometrial sutures (Fig. 169 B). The plastic reconstruction of the uterus was completed by a third layer of interrupted sutures, uniting myometrium and serosa (Fig. 169 C).

A hystrogram taken 15 months after the operative procedure showed a rather large, but symmetrical, uterine cavity. Two years after the operation the patient reports that she was menstruating painlessly every 2 to

3 months. She was only 16 years old at this time and was not married.

### SURGERY FOR PYOMETRA

Faulty drainage of one or both horns of a double uterus may make infection more serious than in the normal uterus. Pyometra and/or pyosalpinx may result and eventually may require major surgery. Figure 170 is the uterus of a woman whose left uterine horn was infected by artificial, intra-uterine insemination. The infection reached the peritoneal cavity, and a pelvic abscess resulted. This was drained by culpotomy, and the patient was in relatively good health for 4 years. Then she developed severe abdominal pain, and on one occasion there was a sudden gush of a large quantity of pus from the vagina. In spite of this spontaneous emptying of the pyometra, the patient continued to have pain, and surgery became necessary. The unilateral pyometra and pyosalpinx shown in Figure 170 were found. Because the patient had been married and sterile for ten years the entire double uterus and left adnexa were removed. The right adnexa, being normal, were saved. The patient has remained well since the operation.



FIG. 171. Hystero-gram of bicornuate uterus with thick septum.



FIG. 172. Hystero-gram of two completely separate corpora with a single cervix.

### SURGERY FOR HISTORY OF HABITUAL ABORTION

Probably the most important indication for surgery on the double uterus is for the cure of habitual abortion. There is no doubt that pregnancies occurring in the double uterus abort more frequently than when occurring in the normal uterus. Miller collected 67 pregnancies in didelphic uteri with an abortion rate of 28.3 per cent. Smith in an analysis of 35 such patients noted an over-all abor-

tion incidence of 23.5 per cent. Schauffer reported on 11 patients with 32 pregnancies and 17 abortions, an incidence of 53 per cent. Hoyt C. Taylor reported 11 patients, 8 of whom were exposed to pregnancy. There were 12 pregnancies with 4 abortions, or 33 per cent. Jones and Jones, in reviewing 52 pregnancies in 21 women at the Johns Hopkins Hospital, found an incidence of abortions of 27 per cent. All of the above figures are substantially higher than the 10 to 15 per

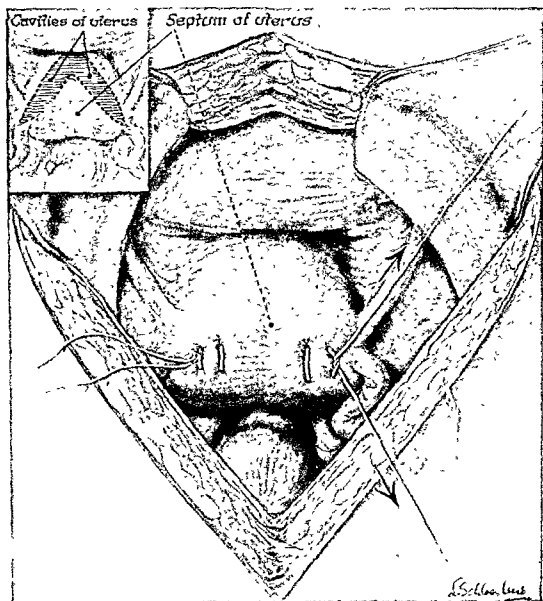


FIG. 173. Appearance of the uterus at operation. The inset shows the cavities as found after opening the uterus.



FIG. 175. (A, *top*) Incision has been made through the anterior and the posterior walls. The septum is being excised. (B, *bottom*) The uterus has been bisected. After excision of a wedged-shaped segment it was necessary to excise additional tissue to unroof each horn. The two halves are being united by continuous sutures through the endometrium.



occur later than the 3rd month of pregnancy.

Figure 173 illustrates a bicornuate uterus with a septum as indicated in the inset. Following a unification operation the patient became pregnant after about a year and a half, and a term baby was born by cesarean section. The uterus as seen at cesarean section is shown in Figure 174 A and B.

The operation done in this case is shown in Figure 175 A, B and C. Longitudinal incisions were made through both the anterior and the posterior walls of the uterus and the septum excised (Fig. 175 A). The

two halves of the uterus were then anastomosed, uniting the walls in 3 layers. The first suture was continuous of No. 0 and united the endometrium (Fig. 175 B). The second suture line was of interrupted No. 0 catgut; it united the myometrium as shown in the inset in Figure 175 C. Finally, the serosa and the superficial myometrium were united with interrupted sutures of No. 0 catgut as shown in Figure 175 C.

The procedure for unifying a double uterus will naturally vary, depending on the exact anatomic condition. Figure 176 shows

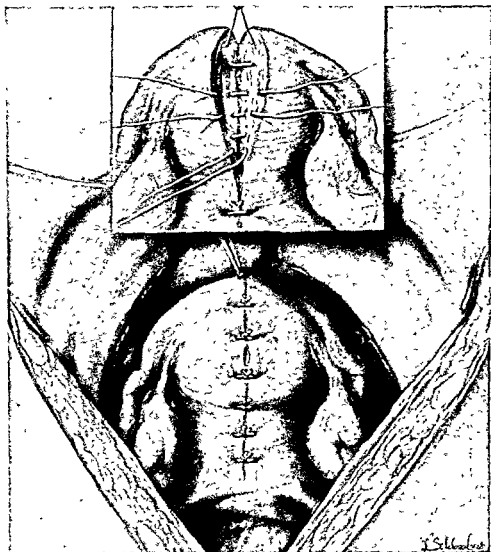


FIG. 175 C. Inset shows myometrium being united. The principal picture shows the final sutures in place and a relatively normal-looking unified uterus.

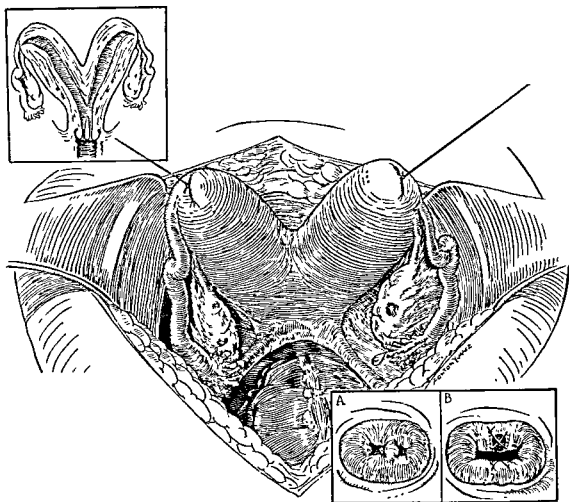


FIG. 176. Double uterus with double external os divided by septum but with single cervical canal higher up. Septum at external os was first excised from below as shown in Figure 177 A and B.

the method used in the case of a didelphic uterus with a small septum in the lower part of the cervical canal. The septum in the canal was first excised per vaginam as shown in the insets in Figure 176 A and B.

The inner walls of both uteri and the septum were excised, leaving the opened uterus as shown in Figure 177 A. A rubber male catheter was pushed downward through the cervical canal and into the vagina. The end of the catheter was left upright in the cavity, so that the anastomosis could be made around it. The anastomosis was made with

3 layers of sutures as shown in Figure 177 A. Figure 177 B shows the anastomosis almost complete and the resulting normal-appearing uterus.

In our clinic, Jones and Jones found that among the patients who had a history of 3 or more abortions followed by a unification operation over three fourths of them went to term with one or more pregnancies. It is noteworthy that these patients were evaluated endocrinologically and metabolically and selected for surgery after serious metabolic or endocrine disorders had been ruled out.



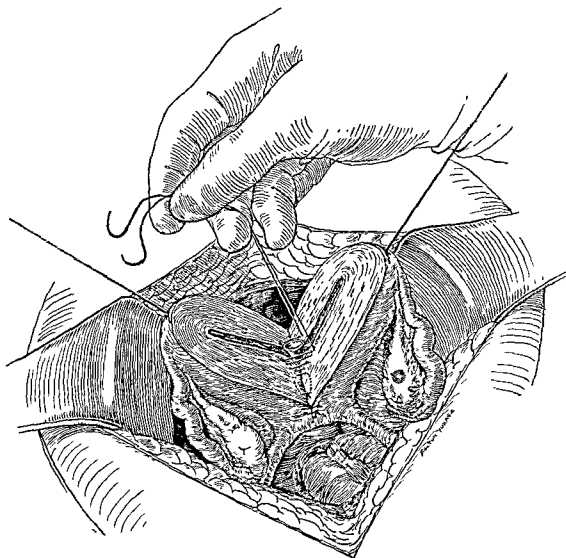


FIG. 177 A. The medial portions of both uteri have been excised. A catheter has been inserted downward through the cervix. Suturing is done around the catheter in the uterine cavity. The 3 layers of closure of the myometrium and the serosa are indicated in this sketch.

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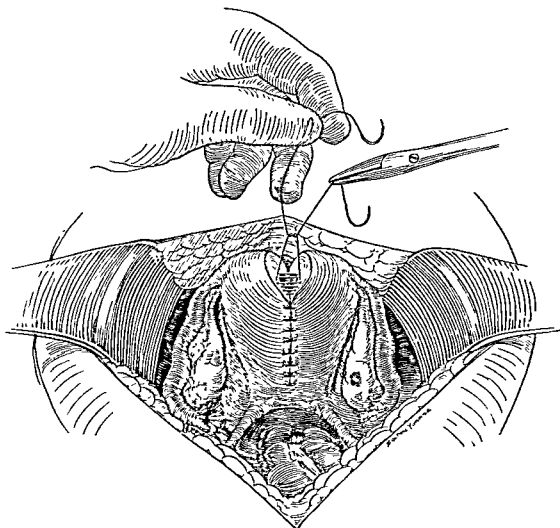


FIG. 177 B. The closure is almost complete, and the resulting single uterus appears to be almost normal.

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# Nonmalignant Cervical Lesions and Their Treatment

Nowhere in gynecology is there such confusion as in the terminology and the exact understanding of benign cervical lesions. Before discussing operative measures for dealing with these lesions, some clarification of the pathology and definition of terms as accepted and used by the author are necessary.

## CONGENITAL PSEUDO-EROSION

This term, as used here, refers to a reddened zone about the external cervical os found in a considerable percentage of nulliparous women (Fig. 178). It does not appear to be the result of inflammation, although such cervixes are probably more susceptible to infection than others. The reddened zone is due to the fact that the columnar epithelium, which in the normal average cervix ends at the external os, in some cases meets the stratified squamous epithelium at a variable distance outside of the os. Tissue biopsied from such a zone is found to be covered with a single layer of columnar epithelium; because of this the subjacent blood vessels color the area deep red, in contrast with the dull pink of the rest of the portio which is covered with stratified epithelium of several cell layers in thickness. Because of the frequent occurrence of this condition in young virginal women without any abnormal cervical discharge, we believe it to be of congenital origin. Therefore, we prefer the term "pseudo-erosion." Norman Miller has suggested the term "ectoplasia." This term undoubtedly is more descriptive of the condition than any other thus far suggested but has not been accepted generally. Curtis takes exception to our point of view and that of Miller

and states that in a large percentage of cases there is actual ulceration. He believes that the destruction of the cervical epithelium is the result of maceration of the epithelial covering by cervical discharge. Therefore, he clings to the term "erosion." Because in many of the cases there is no discharge and an intact epithelial covering, we cannot subscribe to this point of view. On the other hand, it must be admitted that a cervix with a pseudo-



FIG. 178. "Pseudo-erosion" or "ectoplasia" of nulliparous cervix.

erosion is more susceptible to nonspecific infection than a cervix whose portio is covered entirely by the thicker stratified epithelium. This infection may result in real, but superficial, ulceration. We believe that the term "erosion" should be reserved for those cases in which there are infection and actual loss of surface epithelium. It seems important to distinguish between these two lesions, because the pseudo-erosion, per se, requires no treatment, but when there are infection and an annoying discharge the cervicitis should be treated. In the past, many of the pseudo-erosions have been treated unnecessarily by applications of medications and by the cautery. After destroying the columnar surface epithelium, usually it is replaced by stratified epithelium; the appearance of the cervix changes, but nothing else is accomplished. Such treatment, which is the result of lack of understanding of the underlying pathology, is meddlesome and should be avoided.

### CERVICAL LACERATIONS

Lacerations of the cervix of sufficient degree to be a source of future trouble result almost exclusively from childbirth. Lacerations of the cervix incurred by cervical dilatation in performing a diagnostic curettage may give rise to acute hemorrhage at the time but seldom give future trouble. Childbirth tears are usually bilateral but may be unilateral or may radiate out from the ex-

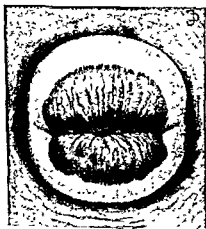


FIG. 179. Lacerated cervix with everted endocervix.

ternal os into the anterior or the posterior lip. At the time of the laceration, infection is permitted to enter the cervical tissues and may lay the foundation of a persistent chronic cervicitis and a resulting vaginal discharge. As a result of bilateral laceration and infection, scar tissue forms, and as it contracts the endocervical canal is turned outward. This eversion or ectropion (Fig. 179) exposes the deep-red endocervix to view through a speculum. Infection is the rule in this type of cervix, and small abrasions may occur on the everted surface. When rubbed with a cotton applicator, slight bleeding usually is easily induced. Profuse mucopurulent leukorrhea is common from such a cervix. The treatment of cervical lacerations is discussed later in this chapter in considering cervicitis and the various operative procedures.

### CERVICITIS

Acute cervicitis is usually the result of gonococcal infection, and consideration is given to it in the chapter on gonorrhea. As a result of delivery or abortion, the cervix frequently becomes lacerated, and the bacterial flora of the vagina enters the cervical stroma and infects it. The acute phase of this infection is transient, but the organisms frequently persist in the tissues, and chronic cervicitis results.

Chronic cervicitis is one of the commonest of gynecologic lesions; in fact, if one were to consider the condition from a strictly histologic point of view, one would be forced to the conclusion that the majority of cervices are to some degree infected, for it is unusual to examine a section of a cervix histologically without seeing some evidence of infiltration by inflammatory cells. The usual microscopic picture of the chronically inflamed cervix is that of infiltration with round cells and to some degree with plasma cells and polymorphonuclear leukocytes. Even in the lesser degrees of inflammation the infiltration is well down into the depths of the cervical tissue, concentrating especially about the glands to their full depth. These compound mucous-secreting glands extend down into the cervical interstitial tissue for as much as a centimeter. It is important to recognize this deep penetration of the infection if one is to treat the condition intelligently; the

FIG. 180. "Epi-  
dermidization" or  
"squamous meta-  
plasia" in cervical  
glands.



futility of applying medication to the surface of the cervix in attempting to eradicate the infection is obvious. From histologic examination of innumerable cervixes we conclude that the term "endocervicitis" should be abolished. Even though there is no visible evidence of inflammation of the portio the infection extends deeply into the cervical tissue from the endocervix, and the term "cervicitis" describes the condition much more accurately. As a result of the deep infection of the glands, they are stimulated to hypersecretion of mucopurulent secretion, which is the source of the troublesome leukorrhea.

The appearance of the chronically infected cervix is extremely variable. It may appear quite normal through the speculum, even when a profuse discharge is pouring from the external os. When there is an old laceration, the appearance varies greatly, depending upon the amount of ectropion. The everted endocervix is deep red even when normal; when inflamed it appears angry and often granular. This everted mucosa is exposed to the vaginal flora and, if not originally infected, such a cervix is apt to become so. Small abrasions are common on the everted tissue, and rubbing the tissue with a cotton applicator frequently causes bleeding. The infection often results in sealing together the

lumina of the cervical glands, and retention cysts result. These "Nabothian follicles" may be numerous and range in size from a few millimeters to a centimeter. On palpation, such cysts are often felt elevated above the surface of the cervix as shotty nodules; the sensation is quite different from that encountered from friable, carcinomatous tissue. Upon opening the glands they pour forth glary fluid, which may be quite clear or mixed with pus.

As a part of the routine gynecologic examination, the cervix should be inspected under good illumination. One of the dividends that has resulted from cytology is that it has made doctors "cervical inspection conscious." The appearance of the inflamed cervix, and especially the everted lacerated cervix, frequently makes biopsy of a suspicious area necessary to differentiate it from cancer. The microscopic criteria necessary to a diagnosis of early carcinoma are discussed at length in the chapter on cervical cancer in situ. There are certain benign lesions of the cervix that simulate malignancy, and a familiarity with these lesions is necessary to prevent serious errors in the histologic interpretation of biopsy specimens. Mistakes are commonly made in the interpretation of these lesions; hence, many uteri are sacrificed unnecessarily. The lesion most often confused



FIG. 181. Marked epidermidization in cervical polyp. (A) Low power, showing many epithelial pearls. (B) High power, showing benign nature of epithelial cells.

with early cervical cancer is *epidermidization* or *squamous metaplasia*. These two terms are applied to the condition because of a difference in the theories of its origin. Robert Meyer believes that during the healing proc-

ess of cervicitis the stratified squamous epithelium creeps along the basement membrane beneath the columnar epithelium, lifting up and destroying the latter. The microscopic picture frequently seen would seem to sup-

port this theory. The term "epidermidization" would seem to be a suitable one for this process. The term "metaplasia" has arisen from the belief of some histologists that there is an actual metaplasia of the columnar cells into cells of the stratified squamous type. Novak doubted this theory but felt that some other theory than that of Meyer is necessary to explain the islands of stratified epithelium lying deep in the cervical glands, far removed from the stratified squamous surface epithelium, and having no continuity with it. He suggests the possibility that these squamous epithelial islands may arise from indifferent cells beneath the cylindrical cells, possessing differentiation potentialities which permit them to develop into squamous epithelium. Regardless of the origin of this abnormal epithelium, the fact is that it may form patterns that simulate early cancer. This resemblance is most apparent under low power (Fig. 180). Under high power the cells look distinctly less active than those of early cancer (Fig. 181). Mitotic figures are absent or rare; hyperchromatosis is lacking, and the cells are uniform in size and staining qualities. To the inexperienced the low-power microscopic picture may strongly suggest cancer, but to the experienced gynecologic pathologist the picture is so familiar that it can be recognized at a glance. Nevertheless, in every case a careful high-power examination should be made for confirmatory evidence. The final answer to the malignant potentialities of these lesions can be determined only by a careful follow-up study of a series of women from whom such biopsy specimens were obtained. The author has made such a follow-up study, following the cases for several years. In no instance was it found that cervical cancer developed on the basis of pre-existing "epidermidization" or "squamous metaplasia."

The treatment of chronic cervicitis should be considered from the point of view of its ability to produce an annoying discharge, to act as a focus of infection, to prevent conception and to predispose to cancer. There is no doubt about the desirability of eradicating the source of the disagreeable discharge, and for this reason cervicitis is most frequently treated. There is one necessary word of warning. One should make certain

before treating the cervix that it is the origin of the discharge and that the discharge does not arise from the inflamed vagina. The question of treating cervicitis for the eradication of an infection that might be acting as a focus for some distant disease is not easily answered scientifically with certainty. Among good gynecologists and internists one encounters wide variation in opinion. There is no doubt that the cervix may harbor virulent streptococci, but the proof that they are responsible for the disease under consideration is lacking. The author has cauterized many cervixes to eradicate possible foci of infection for arthritis. In spite of this rather extensive experience we must admit considerable skepticism as to the benefits. Usually the decision to cauterize is easily made, because the elimination of the discharge is in itself desirable, but one is never justified in promising that clearing up of the cervical infection will materially affect the arthritis. As a matter of fact, with increased experience faith in the idea that infection in the cervix is an etiologic factor in arthritis seems to be waning.

The clearing up of a thick mucopurulent discharge is desirable as an aid to fertility, and we have seen pregnancies occur after doing so. On the other hand, how frequently does pregnancy take place in spite of a severe cervicitis with a profuse thick mucilaginous leukorrhea!

Finally, cervixes which are the site of rather marked infection should be treated as prophylaxis against the development of cancer. There is definite clinical evidence that cervicitis in some measure predisposes to subsequent cervical malignancy. The subject is discussed in full in the chapter on cervical carcinoma, to which the reader is referred. It is sufficient to point out here that most cervical carcinomas begin at the junction of the columnar and stratified squamous epithelium, at or near the external os. The operator should bear this in mind when deciding upon the proper treatment of the cervicitis.

At the outset we should like to condemn the practice of total hysterectomy as a method of treating chronic cervicitis. It is done all too frequently when a lesser procedure will clear up the discharge. If the operator attempts to justify the major surgery on the grounds that the cervix is suspicious of malignancy, he is

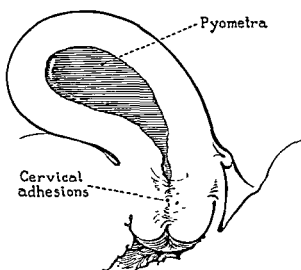


FIG. 182. Pyometra, resulting from benign cervical stricture due to postmenopausal cervical adhesions.

at fault. If the cervix is malignant, an ordinary total hysterectomy is not adequate treatment. If it is not malignant, the treatment has been excessive. Smear and proper biopsying of the cervix will definitely establish or rule out malignancy, and these procedures should be done before definitive treatment is undertaken.

The various procedures for the treatment of chronic cervicitis are considered later in this chapter. The operative procedures of cauterization, conization, Sturmdorf tracheloplasty, amputation and trachelorrhaphy are evaluated in the light of our present experience.

### STRICTURE OF THE CERVIX

Acquired stricture of the cervix is a common lesion, and its consequences may be serious. The most common etiologic factors in the formation of cervical stricture are the various therapeutic operative procedures directed at the cure of cervicitis. If these are performed improperly, or if the cervix is not taken care of adequately during the period of convalescence, complete or partial occlusion of the cervix, either at the external os or within the canal, may result. Conization of the cervix is more apt to result in stricture than cauterization. The circular scar, resulting from certain types of cervical amputation or radium applied for either benign or malignant uterine disease, may cause the cervical canal to contract and form occluding

adhesions within its lumen. Likewise the normal menopause may so shrink the upper vagina and/or the cervix as to obstruct drainage completely. In addition to these etiologic factors, which are generally recognized as being responsible for cervical stricture, Curtis believed that any instrumentation of the cervical canal, such as curettage or instrumental abortion, may result in occlusion of the canal by adhesions. He also believed that gonorrheal disease is perhaps the commonest of all the causes of cervical stenosis. Our clinical experience has not brought us to agree with him, but we do admit the finding of cervical stenosis occasionally when nothing in the history gives a clue as to its etiology. Our experience on the colored ward, where gonorrhea is very prevalent, and our laboratory examination of the uteri from patients operated upon for the residue of gonococcal disease have not led us to conclude that it plays an appreciable role in the subsequent development of cervical stricture.

Acquired cervical stenosis, occurring before the menopause, gives rise to severe dysmenorrhea and, if the occlusion is complete, hematometra, hematosalpinx and hemato-peritoneum result with severe lower abdominal pain and signs of peritoneal irritation. Brownish discharge during the month is common, as the retained uterine blood eventually finds its way through the cervical canal. The possible relationship of this condition to pelvic endometriosis is worthy of consideration



but has not been proved. Adhesions in the cervical canal may cause pocketing of infectious material and be responsible for persistent purulent discharge.

After the menopause pyometra often, although not always, results from cervical occlusion (Fig. 182). Lower abdominal pain, fever and a history of intermittent purulent discharge are common. On the other hand, we have noted on several occasions complete occlusion of the cervical canal in elderly women on whom operation for prolapse was being performed without pyometra.

The treatment of cervical stenosis is thorough dilatation. Considerable searching and probing with the uterine sound or fine probe may be necessary to locate the external os or to find the passage into the uterine cavity. When the occlusion is due simply to sealing

together of the cervical lips externally, the membrane may be punctured and the external os easily dilated without anesthesia. This condition obtains not uncommonly after cervical cauterization and also spontaneously after the menopause. When there is stenosis higher in the canal, anesthesia must be resorted to in order to secure adequate dilatation. One must be governed in the degree of dilatation by the condition of the cervix. When the cervix is large and strong, as in the premenopausal woman, dilatation may be more vigorous than in the atrophic postmenopausal cervix that may be torn easily. When pyometra is present, the least instrumentation necessary to secure drainage is the wisest. Even after simple cervical dilatation, there may be a flare-up of temperature. Endometrial or endocervical carcinoma is



FIG. 183. Large cervical polyp arising from endocervix associated with prolapse of the uterus.



FIG. 184. Cervical polyp arising from endocervix.

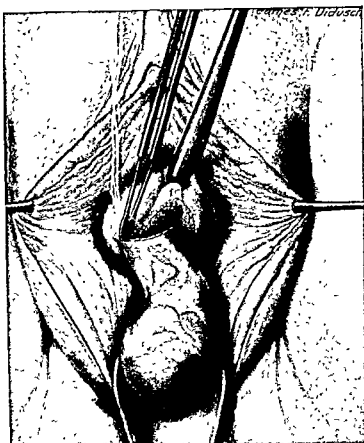


FIG. 185. Removal of large polyp with heavy pedicle by cautery. Dotted line indicates line of excision.

justly suspected in all cases of postmenopausal pyometra and particularly when the discharge is blood-tinged. However, curettage never should be done at the time of dilatation, but the patient should be given antibiotic therapy and return for curettage a month after the drainage has been established.

### CERVICAL POLYPS

Cervical polyps are among the commonest lesions encountered in gynecology. They may be single, but multiple polyps are not uncommon. Cervical polyps may appear at any time after puberty, but they develop more frequently in the latter half of menstrual life and after the menopause. Etiologically, they are considered by most gynecologists to be dependent upon cervicitis, but this generally accepted view is difficult to prove, and we confess to some skepticism. Cervical polyps are commonly encountered in virginal women with no history of leukorrhea to cause one to suspect pre-existing cervicitis. Furthermore,

chronic cervicitis is such a common lesion that the occurrence of polyps with it may well be coincidental. It is probably more nearly in keeping with scientific facts to admit that the cause of polyp formation on the cervix is as much unknown as the cause of other benign neoplasms.

The term "polyp" is strictly a morphologic one, and there is considerable variation in the histologic composition of different polyps. Most of them are pedunculated and connected to the cervix with a slender pedicle, but fibrous and fleshy elevations that are sessile probably represent polyps in the process of growth. Most polyps arise from the endocervix; hence, they are covered with a single layer of columnar epithelial cells. Like the endocervix, such polyps are deep red in color (Fig. 183) and bleed easily on contact. Histologically, they are treelike structures, rich in glands with connective tissue cores that are composed of loose connective tissue with many blood vessels (Fig. 184). Much less commonly, polyps arise from the vaginal

surface of the portio. These are grossly different in appearance as well as histologically. They are light pink in color due to the fact that they are covered with thick squamous epithelium. The pedicle connecting a polyp of this type with the cervix is apt to be thicker than that of the endocervical polyp, and the whole structure is firm and fibrous (Fig. 185). Glands do occur in polyps of this type, but usually they are much sparser than in the endocervical polyp.

The relation of cervical polyps to malignancy deserves special consideration, for errors in the interpretation of the histologic patterns are not uncommon. The incidence of carcinomatous change in originally benign cervical polyps is very small, but such change does occur, making it desirable to examine histologically each cervical polyp that is removed. Also, on rare occasions an endocervical malignancy may protrude from the external os as a polypoid structure, resembling the ordinary benign polyp. Special consideration should be given to "epidermidization" or "squamous metaplasia" in relation to cervical polyps, for the condition is extremely common in polyps and not infrequently it is erroneously diagnosed as malignant. Figure 181 shows extreme "squamous metaplasia" with pearl formation that occurred in a benign polyp. The patient from whom this polyp was removed was followed for over 10 years and remained free from symptoms. The rules for distinguishing between malignancy and benignancy in cervical polyps are the same as for elsewhere in the cervix, and because of the great incidence of cancerlike benign changes in polyps, it is important to bear them in mind always.

Cervical polyps are often entirely asymptomatic and are incidental findings in the course of routine pelvic examinations. Freedom from symptoms is much more apt to be the case when polyps arise from the surface of the cervix than from the endocervix. Endocervical polyps are much more liable to ulceration and infection; hence, mucopurulent discharge results that is often blood-tinged. A common history is one of spotting a few days before and after the menstrual periods or after coitus.

The finding of a cervical polyp, symptomatic or asymptomatic, is indication for its

removal and microscopic section. A small polyp is easily twisted off with a Kelly clamp in the office or the out-patient department (Fig. 186). If a cervix is found to have a tendency to the re-formation of polyps, the patient should be anesthetized and the cervix well dilated, so that the canal can be thoroughly curetted and the site of polyp formation touched with the cautery. Often a radial cauterization is necessary to clear up the accompanying cervicitis. Large polyps with broad fibrous pedicles arising from the portio may be best removed by the cautery (Fig. 185).

## LEUKOPLAKIA OF THE CERVIX

Leukoplakia of the cervix (Fig. 187) has been much discussed in recent years as a possible precancerous lesion. There is little

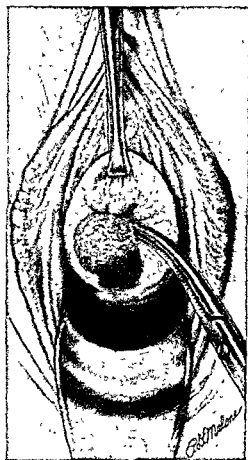


FIG. 186. Polyp attached to endocervix. Pedicle grasped with Kelly clamp and about to be twisted off.

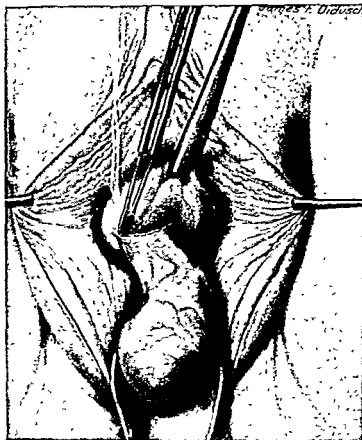


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FIG. 186. Polyp attached to endocervix. Pedicle grasped with Kelly clamp and about to be twisted off.

unanimity of opinion as to the microscopic picture as well as the interpretation of leukoplakia in its relation to cancer. In the opinion of the author the term "leukoplakia" should be considered only as a descriptive clinical term indicating a white area on the cervix, without attempting to infer the presence of a particular microscopic picture. Biopsied leukoplakic tissue may show a variety of histologic pictures. In some specimens we have detected little, if any, change from the normal; in others there is simple hyperkeratosis with slight basal cell overactivity; in a very few we have found undoubted carcinoma-in-situ. It must be emphasized that most leukoplakic areas are not malignant, and Meyer believes that there is little or no justification for the belief that cancer develops on leukoplakic areas any more than on cervical polyps. From a practical point of view the question boils down to the advisability of biopsying all leukoplakic areas. We believe that this should be done, just as we biopsy cervical polyps, and in a very small percentage early cancer will be found.

### OPERATIVE PROCEDURES

The various operative procedures used in our clinic for the eradication of benign cervical disease are discussed in the following pages. It is understood, of course, that the complete elimination of the cervix by total



FIG. 187. Leukoplakia of the cervix. All of the leukoplakic areas in this case proved to be intra-epithelial carcinoma, but real invasive carcinoma was found on cutting up the whole cervix.

hysterectomy is desirable when it is the site of benign disease and *when hysterectomy is otherwise indicated*. For a consideration of this the reader is referred to page 307. When benign disease of the cervix alone is the cause for operation the following procedures are useful, observing the indications and the contraindications discussed with each procedure.

### CAUTERIZATION OF THE CERVIX

In 1906 there appeared in the *Journal of the American Medical Association* an article on "The Treatment of Leucorrhea with the Actual Cautey" by Guy L. Hunner. This article was destined to initiate the general use of the actual cautey in modern gynecology for the treatment of chronic cervicitis. Although many other procedures have been proposed and used from time to time, cervical cauterization still remains the most generally useful method at our disposal, while some of the other procedures have been discarded or have remained to be used on special indication. Hunner's method was "cauterization by deep radial incisions," and this method has made cauterization popular by virtue of its excellent results. At the time of his original publication in 1906, Hunner was not aware that the actual cautey had been used upon the human cervix. Later, he became interested in ascertaining whether or not anyone had preceded him with this idea. In 1935 he published "A Historical Summary" on the subject.

The following quotation from Hunner's historical sketch indicates that the use of the cautey is hardly a modern innovation, but that it had been used extensively and abandoned at a much earlier period because of generally unsatisfactory results:

According to the English gynecologist, James Henry Bennet, Celsus used the actual cautey for treating ulcers of the prolapsed uterus. About the middle of the last century Jobert de Lamballe, the talented Paris surgeon, used the actual cautey in treating the ulcerated cervix as well as in cases of severe inflammatory hypertrophy. Bennet says that Jobert always used the conical ivory speculum to protect the vaginal walls from the radiated heat, but this "is not, however, indispensable. One or two olive-shaped cauterics, heated to whiteness, may then lie extinguished on the part of the cervix

which has to be cauterized. An eschar, more or less deep, is thus formed, as by cauterization with *potassa fusa*. It is necessary that the cautery should be brought to a white heat, or otherwise it adheres to the tissues on being withdrawn. But little pain is experienced by the patient, either at the time or subsequently, the eschar falling off from the sixth to the tenth day, according to the depth of the cauterization. When the actual cautery is used to remove inflammatory hypertrophy, two or more cauterizations may be necessary to restore the neck of the uterus to its natural size."

It appears from Bennet's discussion of the relative merits of the actual cautery and the Vienna paste (which Bennet preferred) that both methods involved the entire circumference of the cervical canal, and unless used with discretion, serious stenosis resulted. It is probable that the preponderance of bad results in the hands of the profession at large finally led to the practical abandonment of these methods

so successfully practised by a few discreet surgeons as far back at 1840.\*

Hunner's contribution is the introduction of a *method* of cauterization by which the disadvantages, which led to the abandonment of the use of the cautery on the cervix, were overcome. His method consists of making deep radial strokes for the destruction of the deep cervical glands with the surrounding areas, leaving enough healthy stroma between the cautery strokes to ensure against future stenosis and dystocia. The necessity of fairly deep strokes becomes obvious if one is familiar with the histology of the cervix. The bases of the racemose glands lie as much as a centimeter deep in the cervical stroma, and

\* Hunner, Guy L.: The cautery treatment of cervicitis: a historical summary, *Journal-Lancet* 55:59, 1935.

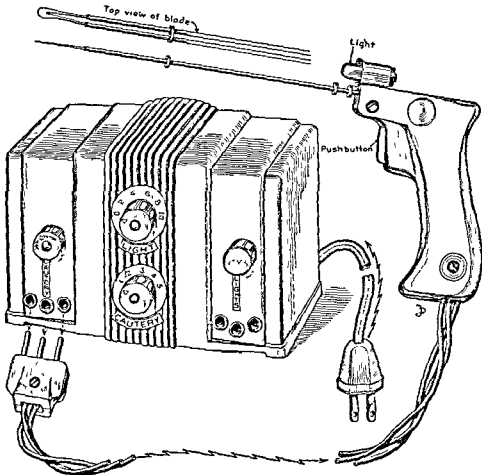


FIG. 188. Small cautery well adapted for cervical cauterization.

superficial cauterization destroys only the mouths of the glands and leaves the bases untouched.

Hunner first used the Paquelin cautery with quite satisfactory results, but later with the improvement in thermocauteries, he displaced the Paquelin cautery with a more modern type. Figure 188 shows the cautery that the author has found admirably adapted to cervical cauterization. It is inexpensive and rarely gets out of order. The small light bulb gives adequate illumination to visualize the cervix well, and the blades are sufficiently heavy to burn widely and deeply enough to destroy the glands. It is less clumsy than the larger cauteries in general use in operating rooms. Because of the ease with which it can

be handled, it is admirably suited for office use without anesthesia.

Hunner originally advocated office cauterization without anesthesia. To the inexperienced, this might appear unnecessarily cruel, but there is a complete absence of heat-conducting nerve fibers in the cervix, and if one is careful to keep the cautery away from the vagina, there is no sensation of burning. The slight discomfort in the abdomen that some patients experience with it is due to the insertion of the cautery blade into the cervical canal. The same sensation can be reproduced by the insertion of a cold applicator. The absence of anesthesia is naturally an advantage, and we have practiced it extensively with satisfactory results. When the vagina is large and parous and the cervix large, lacerated and patulous the operation can be carried out with the greatest of ease. Also, in many nulliparous women it can be done quite satisfactorily, but when the cervical canal is of very small caliber, considerable dilatation may be a prerequisite to satisfactory cauterization, and this cannot be done adequately on the unanesthetized patient. The disadvantages of anesthesia were greater in the era in which Hunner published his views than they are today. Nitrous oxide and ether anesthesia are not pleasant to take, and even less pleasant on recovery. Intravenous Pentothal Sodium is pleasant both on administration and on recovery, and after cervical cauterization the patient may return to her home on the same day. When done under anesthesia, the cauterization is usually more thorough than when done on the unanesthetized patient, and in almost all instances only one cauterization is required. The ultimate result is usually as good when cauterization is done piecemeal on the unanesthetized woman, but since a period of sloughing of a few weeks follows each cauterization, the prolonged period in which there is a foul discharge is objectionable. However, in many instances the cauterization can be completed at once quite satisfactorily without anesthesia.

Following the cauterization there is an increase in vaginal discharge, and it is well to warn the patient of this. Within a day or two a watery discharge usually appears. As the burned tissues become necrotic and infected, the discharge increases and becomes

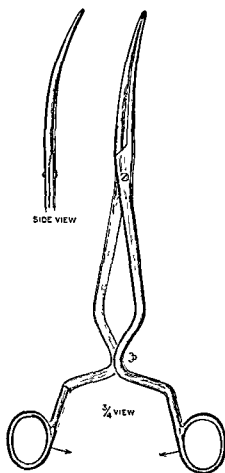


FIG. 189. Special pointed dilator, used to prevent cervical stenosis following cauterization.



foul-smelling. At about the 10th or the 12th day it is not unusual for the discharge to become tinged with blood, and in some instances there is real bleeding. Very rarely, alarming hemorrhage occurs which must be controlled by a tight vaginal pack. Douching with potassium permanganate (1-5,000) or P.M.C. douche powder is advised, beginning 2 days after the cauterization. The patient should be warned not to insert the nozzle too high in the vagina in order to lessen the chance of initiating bleeding. When the discharge becomes very profuse and foul, 2 douches a day may be desirable. In approximately 3 weeks the sloughing is complete,

and the discharge gradually is reduced as healing takes place. Complete healing usually requires about 5 weeks. Even though the cauterization is done by the proper radial method, precaution should be taken against resulting cervical stenosis. As prophylaxis against this, the patient is instructed to return a month after the cervix has healed completely. The patency of the cervical canal is then tested with a sterile uterine sound. If evidence of stenosis exists, dilatation is done. For this purpose the author uses a small, pointed dilator (Fig. 189). Dilatation may be done quickly with this but not painlessly; however, the pain is momentary.

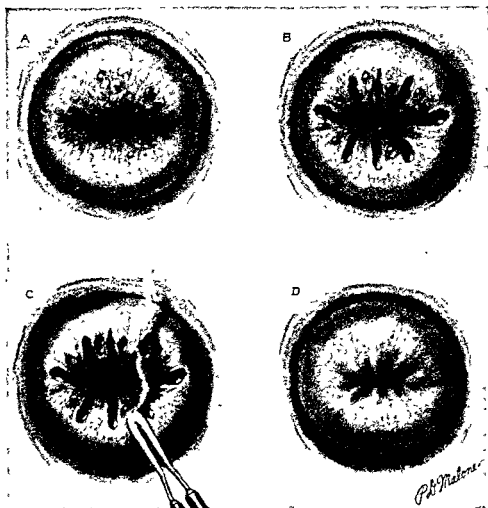


FIG. 190. Cauterization of cervix. (A) Indicates infected cervix with many Nabothian cysts. (B) Indicates radial cauterization marks. (C) Cysts are destroyed individually with cauterization blade. (D) Appearance of cervix 6 months after cauterization.

The value of cervical cauterization as prophylaxis against cancer is suggested by Scheffey who states:

For many years I have made it a point never to leave a cervix uncauterized when performing supravaginal hysterectomy and in no instance, that I know of or learned later, did cancer develop in these cauterized cervixes. In furthering this plan I treated all cervixes alike, whether intact or attended by the trauma of childbirth, infection or congenital maldevelopment.\*

Such a statement representing almost the entire lifetime experience of one who was in charge of an active gynecologic clinic is of great importance as evidence for infection as an etiologic factor in cervical malignancy. However, today when total hysterectomy has become an almost routine procedure it has less practical application.

#### TECHNIC: CERVICAL CAUTERIZATION

If the cauterization is done under anesthesia, the cervical canal is thoroughly dilated; if done on the unanesthetized patient, little or no dilatation can be done. Deep radial strokes are taken with the very hot cautery blade (Fig. 190 B). These strokes are carried well up into the cervical canal. If there is considerable eversion of a lacerated cervix, the radial strokes are carried well out on the everted surface. After the radial cauterization, individual Nabothian cysts may be destroyed as shown in Figure 190 C. The final result is usually a remarkably normal-looking cervix (Fig. 190 D). If an ectropion of the cervix was present, the scars formed by the longitudinal strokes of the cautery tend to draw the lips inward. On the whole, the properly cauterized cervix will usually present an ultimate picture more nearly normal than the cervix upon which trachelorrhaphy or tracheloplasty, has been done.

#### CONIZATION OF THE CERVIX

With the invention of the electrosurgical apparatus, conization of the cervix came into vogue, being used extensively in some clinics and very conservatively in others. In our

clinic we have definitely been on the conservative side, but we believe that the procedure is of value, provided that it is used with proper indications. Since our series of "hot" conized cervixes is too small to be of any statistical value, we prefer to evaluate the results from a clinic in which the procedure has been used more extensively. Miller and Todd have reported on a series of 899 conizations done from 6 months to 3 years before the follow-up study. Of these, 747 were done before and 152 after the menopause. No immediate serious complications occurred in the 899 cases. Strictures of the cervix, sufficiently severe to necessitate return for dilation, occurred in 6.46 per cent; probable strictures, as judged by answers to questionnaires, occurred in 2.47 per cent. Usually the strictures that were treated were mild, but there were some in which the entire canal was obliterated by dense scar tissue. Miller and Todd also concluded from a small series of cases in which pregnancy followed conization that the effect on pregnancy was in general harmful. The harmful effect was chiefly in the direction of premature labor and abortion rather than cervical dystocia, as might have been anticipated. Eighteen per cent of the women who became pregnant had premature labor, and in 13.6 per cent the pregnancy ended in abortion.

We have found conization to be of great value in some cases in which hysterectomy is indicated and in which benign disease of the cervix is incidentally present. For technical reasons, or because of the general condition of the patient, total hysterectomy is not feasible in all such cases. We have utilized conization particularly on the colored service where infected cervixes are common, but where large myomas complicated by salpingitis make total hysterectomy much more of a procedure than the subtotal operation. Conization of such cervixes may best be done immediately before placing the patient in position for laparotomy. By such a combination of procedures the advantages of total hysterectomy are nearly attained without subjecting the patient to the added risk of the greater operation. The part of the cervix vulnerable to cancer is removed, as well as the infected cervical glands that give rise to annoying discharge. H. L. Darner has been

\* Scheffey, L. C.: Definitive methods for the prompt diagnosis and management of pelvic malignancy-apophylactic approach, First Asiatic Congress of Obstetrics and Gynecology, Tokyo, Japan, 1937.

a particularly enthusiastic advocate of this and claims excellent results.

We have also used it to advantage when there is particularly severe cervical infection in women approaching or after the menopause. From Miller and Todd's results it may be justly considered a procedure not to be undertaken lightly in women desiring more children. However, when a severe cervicitis has resisted cure by the ordinary cauterization, we sometimes use conization even in younger women.

In recent years we have utilized "cold" conization frequently to obtain a large amount of tissue for microscopic study when ordinary biopsy material failed to give a de-

cisive answer to the question of early cancer. The cone-shaped specimen is obtained with the scalpel in order not to ruin the specimen by heat coagulation. After removing the specimen for biopsy further conization may be done with the coagulating wire loop to control bleeding.

#### TECHNIC

The technic of "hot" conization is very simple. Hospitalization is desirable but not absolutely necessary. We usually administer Pentothal Sodium intravenously and place the patient in the lithotomy position. The cervix is exposed with a proper speculum, grasped with a tenaculum and drawn toward the out-

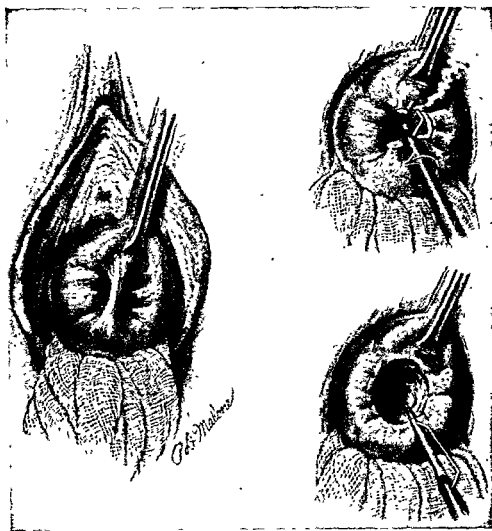


FIG. 191. Conization of cervix. (Left) Shows condition of lacerated cervix. (Top) Electro-surgical coning instrument is inserted into cervical canal and rotated. (Bottom) Showing cervix from which cone of tissue has been removed.

let. The tip of the instrument is placed against the external os, and the combined cutting and coagulating current is turned on. The wire cuts into the cervix to the desired depth, and the instrument is twisted, thus enucleating a cone of endocervix and leaving a base of coagulated tissue that is usually quite dry (Fig. 191). As after cauterization, about 6 weeks is usually required for sloughing and complete epithelialization. A small gauze wick is placed in the cervical canal for 24 hours unless hysterectomy is to follow conization immediately. The patient is advised to use a daily cleansing douche, beginning about the 4th day after the conization, for at this time a blood-tinged discharge usually begins. She is advised to return for observation every 2 weeks. At the time of observation the cervical ulcer is swabbed with merthiolate solution (1-1,000), and a small sound is passed through the cervical canal. If a tendency to stenosis is noted, larger Hegar dilators are passed. We believe that this follow-up is most essential in the prevention of subsequent stricture. At the end of about 6 weeks the coned-out area is usually covered with healthy-looking mucosa, and most of the cervical discharge has disappeared.

### AMPUTATION OF THE CERVIX

The operation of amputation of the cervix is rarely done in our clinic, except in combination with certain operations for prolapse, such as the Manchester, the Interposition and the Richardson Composite operations. It has long since been abandoned as the usual method of treating cases of chronic cervicitis with or without cervical laceration.

To justify our present attitude toward amputation it is necessary to view the operation historically. It was first widely practiced by the French surgeons as a routine means of treating prolapse. Marion Sims, in 1866, advocated the operation for prolapse and also for inflammatory disease of the cervix. He did the operation in young as well as older women and did not believe that it interfered with subsequent pregnancies. T. A. Emmet stated categorically that the operation had no effect on fertility, pregnancy or labor. Important as these men were in their chosen field during their epoch, it is apparent that their fondness for this operation was not

based upon knowledge of the subsequent obstetric histories of their patients.

Audebert, in 1898, was one of the first to direct attention to the ill effects of cervical amputation. In a comparison between pregnancies in the same women before and after cervical amputation he found a great increase in abortions, premature labors and dystocia. Veador Leonard, in 1914, in an extensive analysis of the after-effects of cervical amputation on 128 women at the Johns Hopkins Hospital, found that four fifths of them who might have been expected to become pregnant remained sterile. Of those who became pregnant 50 per cent had premature interruption of pregnancy, and of those proceeding to term an even larger percentage had difficult labors. Carrying the idea of sterility to the extreme, Zoefgen even recommended high cervical amputation for sterilization.

The most recent study of the subject was made by Fisher in 1951 who studied the pregnancies of 7 women after cervical amputation. Before the operation 91 per cent of the pregnancies of these women had gone to successful conclusion, whereas after amputation only 21.5 per cent of the pregnancies ended successfully. The cesarean section rate went up from 0 to 57 per cent; the only surviving babies in the series were delivered by section. Vaginal delivery when attempted was characterized by either a prolonged first stage or an increased latent period between rupture of the membranes and the inauguration of labor.

From the above studies it is clear that amputation of the cervix in women who may subsequently become pregnant is to be condemned strongly. However, there is a selected group of cases in which the operation can be done to advantage; these are essentially women at or near the menopause, in whom there is marked cervical laceration, accompanied by severe infection and, in some instances, a tendency to polyp formation. In those women the question of childbearing need not be considered, and amputation or conization is the procedure of choice.

Every surgeon who has had experience in cervical operations, dating back a quarter of a century, is acquainted with the relative frequency of postoperative cervical hemorrhage and with the difficulty of controlling this at times. When hemorrhage occurs, it is usually

from 7 to 14 days after the operation, at the time when the catgut begins to give way. As a rule, control of the bleeding is not easily accomplished by suturing the friable, vascular postoperative cervix. Because healing after such a secondary operation is tardy and accompanied by infection, the end result leaves much to be desired.

In 1916 Sturmdorf published his method of tracheloplasty. His operation is not a cervical amputation; indeed, one of the virtues claimed for it is this fact. Hence, he advocates it as the operation of choice in the childbearing period. The operation consists of coring out the infected glandbearing tissue that lines the cervical canal and of relining the canal with a flap of mucous membrane dissected free from the vaginal portion of the cervix. The typical Sturmdorf operation is done with much less frequency than formerly, since cervixes that require a destruction of the glands of the endocervix are now treated in most clinics by the cautery or by electro-surgical conization; both of these procedures are discussed elsewhere in this chapter. In rare cases, however, in which cauterization has failed and in which there is a great excess of discharge from large numbers of intra-cervical glands, Sturmdorf conization may prove to be a curative procedure. It is also an excellent method of obtaining complete biopsy material from the region of the external os. We have adopted and applied the Sturmdorf principle of covering the raw surface with a flap of mucosa to the operation of amputation of the cervix and believe that it is superior to other types of amputation. The procedure described is usually less bloody than the average amputation, and postoperative hemorrhage is rarely encountered. The absence of postoperative hemorrhage is due to the fact that the flap of mucosa has healed to the raw surface of the shortened cervix by the time the catgut has become weakened.

#### TECHNIC: LOW AMPUTATION OF THE CERVIX

The operation is carried out more readily if the cervical canal is dilated before proceeding with the operation.

**Step 1.** A circular incision is made around the cervix (Fig. 192 A). The mucous membrane covering the vaginal portion of the cervix is dissected back. The point at which

this incision is made depends upon the length of the cervix and the height at which the amputation is desired. The amount of mucosa freed must be estimated by the operator as sufficient to cover the shortened cervix.

**Step 2.** A suture of No. 1 chromic catgut is placed in both sides of the cervix to ligate the cervical branch of the uterine vessels (Fig. 192 B). If these sutures are well placed, there is usually very little bleeding when the amputation is done.

**Step 3.** Amputation of the cervix (Fig. 192 B). Usually no vessels need be ligated individually, but if there is a very active bleeder it is best to transfix it, using No. 0 chromic catgut. A simple ooze from the cut surface is controlled by the apposition of the mucosal flap.

**Step 4.** Covering of the shortened cervix with the mucosa flaps (Fig. 192 C). Either the anterior or the posterior flap may be apposed first, depending on convenience. This is done by means of a mattress suture of No. 1 chromic catgut on a large cervical needle. The method of placing this suture is best demonstrated by observing Figure 192 D and E. The suture first picks up the anterior flap of mucous membrane in the mid-line. The suture is then carried into the shortened cervical canal, piercing the shortened cervix anteriorly and emerging into the vagina as the flap is pulled downward. Then the other end of the suture is threaded and, in a similar manner, the needle is carried into the cervical canal and out, parallel with the first half of the suture. This mattress stitch is repeated on the posterior lip of the cervix. The edges of the mucosa flaps laterally are approximated and sutured with figure-eight or interrupted sutures, as is necessary. In making these lateral sutures it is well to take a bite in the subjacent portion of the cervix in order to obliterate dead space and thus ensure hemostasis. At the conclusion of the operation the cervical canal should be identified and proved patent by the insertion of a Kelly clamp or a uterine sound (Fig. 192 F).

#### TECHNIC: HIGH AMPUTATION OF THE CERVIX

When the cervix is markedly elongated, the above-described technic of low amputation will not remove sufficient cervix to ac-

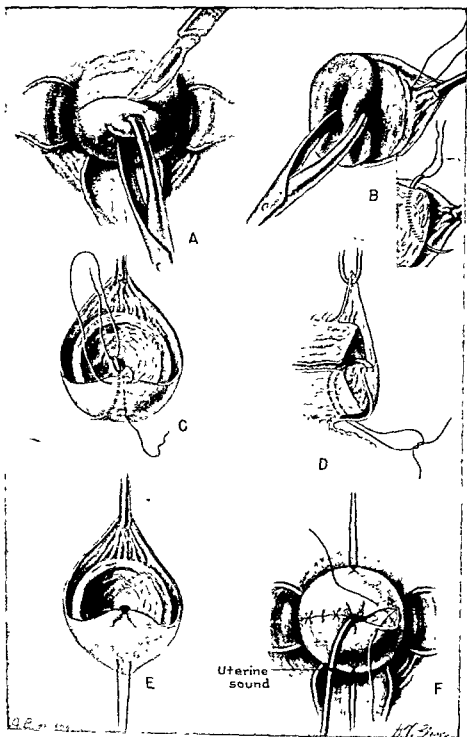


FIG. 192. Low amputation of cervix. (A) Circular incision through the mucosa. (B) Flaps of mucosa have been dissected back. Cervical branches of uterine vessels are ligated. The dotted line indicates level of amputation. (C) Mattress suture is being placed as in Sturmdorf tracheloplasty. (D) Demonstrating method of action of suture in drawing the flap into the canal. (E) The lower flap has been pulled into position. (F) Anterior and posterior flaps have been drawn into the canal. Lateral mucosa wounds are being sutured.

comply the desired end. High amputation of the cervix is often part of the Manchester operation, or simple high amputation with cystocele repair may be the combination of procedures necessary to give the patient complete relief of her symptoms.

The amount of cervix desired to be removed is decided upon, and a circular incision is made through the mucosa, estimating the amount of mucosal flap needed to cover over the shortened cervix. The flap is dissected free around the circumference of the cervix (Fig. 193). In the elongated cervixes, upon which this operation is most often done, the bases of the broad ligaments are often much elongated. Therefore, the broad ligament base is clamped with an Ochsner clamp, parallel with the side of the cervix, and cut. The ligament containing the cervical branch of the uterine vessels is transfixed with a suture of No. 1 chromic catgut. If the cervix is greatly elongated, a second bite of broad ligament may be taken. In placing the suture it is well to bite well into the side of the cervix. If this is done the amputation is relatively dry, and no further hemostasis is necessary in most cases than that effected by the suturing of the flaps over the cut surfaces of the shortened lips. This step is repeated on the opposite side. If a Manchester operation is to be done, the bases of the broad ligament are brought together in front of the shortened cervix. Covering of the shortened cervix is carried out as described and illustrated in low cervical amputation.

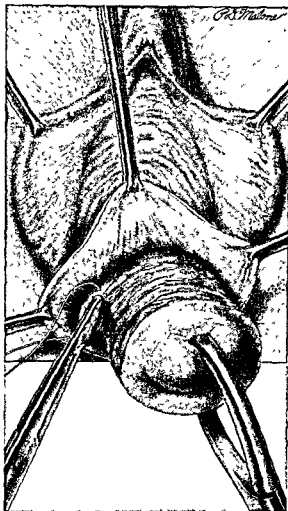


FIG. 193. High amputation of cervix. The lowermost portion of the broad ligament has been clamped and cut. It is about to be sutured with No. 1 chromic catgut.

#### TECHNIC: STURMDORF TRACHELOPLASTY

A circular incision is made about the rim of the cervix, and by blunt and sharp dissection a flap of mucosa is freed about the entire cervix. Mayo scissors and the handle of a scalpel are excellent instruments for this maneuver. Figure 194 A shows the flap completely free.

The region of the external os is grasped with an appropriate instrument. In the illustration a Jacobs clamp is used for this, but this is too large an instrument in some instances, and an Ochsner clamp or even an Allis clip may fit the individual case better.

A cone or core is dissected out of the cervix as shown in Figure 194 B. The apex of the cone should be at approximately the level

of the internal os. Thus, most of the endocervical glands are removed. A small-bladed scalpel is well suited to this task.

The next step is the relining of the cervical canal with the previously prepared mucosa flaps. It is our custom to utilize first the posterior flap. No. 1 chromic catgut, threaded on a large cutting needle, is best suited for the so-called Sturmdorf stitch which is in reality simply a mattress suture. The posterior flap of mucosa is first picked up in the mid-line near the edge. One end of the suture is carried up into the cervical canal with the cutting needle and out through the posterior lip of the cervix, as the mucosa flap is pulled forward. Then the other end of the

suture is threaded into the cutting needle, and the process is repeated. The two ends of the suture should emerge on the posterior surface of the cervix about 5 or 6 mm. apart (Fig. 194 C).

When this suture is pulled taut, the posterior mucosa flap is pulled well into the newly made cervical canal (Fig. 194 D).

This process is repeated on the anterior lip.

Sufficient mucosa is excised from the flaps laterally so that a neat closure may be effected. In some instances none need be excised; in other instances there is considerable redundancy. Approximation of the mucosa edges laterally is usually done with

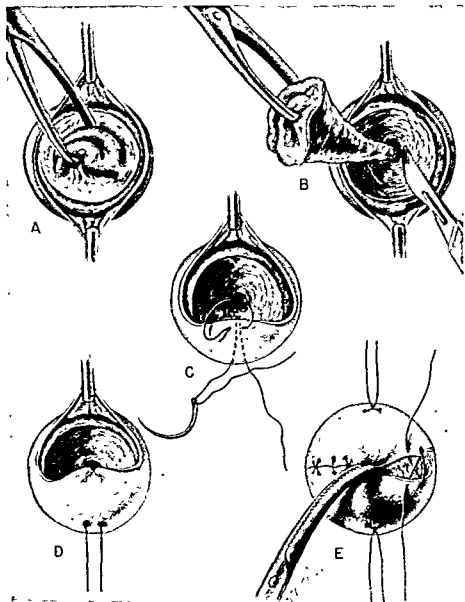
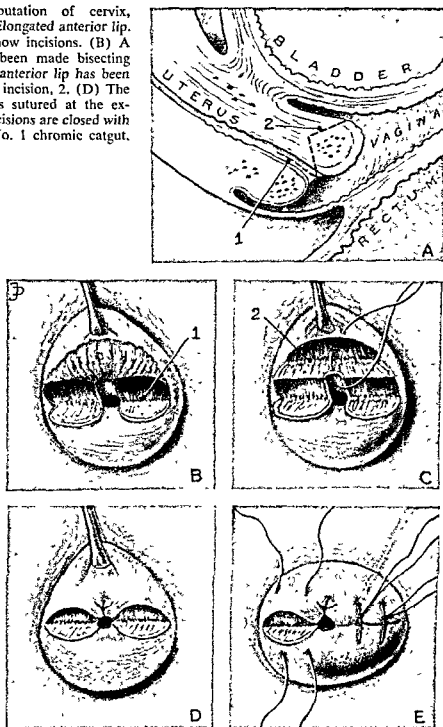


FIG. 194. Sturmdorf tracheloplasty. (A) The circular incision has been made, and mucosal flaps are freed. (B) A cone containing the endocervix is excised. (C) Mattress suture has been placed to cover the posterior lip with mucosal flap. (D) Mattress suture has been pulled tight, drawing the mucosal flap into the cervical canal. (E) Mattress sutures are tied. Lateral mucosa edges are approximated.



FIG. 195. Hemiamputation of cervix, Schröder method. (A) Elongated anterior lip. Dotted lines 1 and 2 show incisions. (B) A transverse incision has been made bisecting the cervix, 1. (C) The anterior lip has been excised with a V-shaped incision, 2. (D) The shortened anterior lip is sutured at the external os. (E) Lateral incisions are closed with interrupted sutures of No. 1 chromic catgut.



interrupted or figure-of-eight sutures of No. 0 chromic catgut. For the sake of hemostasis a bite is taken in the subjacent cervical tissue (Fig. 194 E).

#### SCHRÖDER AMPUTATION

Amputation of the cervix in a manner described by Schröder is still a favorite method in some clinics. It consists essentially of am-

putation of the anterior and the posterior lips after making a transverse incision, dividing the cervix up to the level at which amputation is desired. Each lip is then amputated in a transverse V-manner, after which the tissues are approximated with interrupted catgut sutures. The author prefers the method of amputation described in this chapter, covering the raw area with a mucosa flap

# The Incompetent Cervical Os

## HISTORY

The recognition of the incompetent cervical internal os dates from 1948 when Palmer and Lacomme of France attributed habitual abortion to this uterine defect. In their first communication they reported one case which they had corrected surgically, followed by a term birth. Palmer's operation consisted of excision of a wedged-shaped segment from the anterior uterine wall at the level of the internal os and approximating the edges with interrupted catgut. Lash and Lash of Chicago independently did a similar operation and reported 5 successful cases in 1950. In 1957 they reported 68 cases. Among these patients there were 41 pregnancies and 34 viable babies. However, about one fourth of these women failed to become pregnant.

Shirodkar of India in 1955 reported his technic of attempting to close the dilated pregnant cervix with a strip of fascia lata and reported success in 79 per cent in 43 cases. McDonald of Australia, using heavy silk to encircle the cervix, had success in 43 per cent of 70 cases. More recently, Shirodkar advocated doing the operation in the non-pregnant state. In the United States Barter *et al.* reported success in 72 per cent. In his early cases fascial strips were used, but he has abandoned this material in favor of nonabsorbable mersilene ribbon. Page has used ribbon catgut and strips of Oxyel gauze dipped in benzoin and saturated sterile U.S.P. talc. This is designed to stimulate granulation tissue and scarring. In 1959 he reported such an operation on 6 women, 3 of whom went to term and the other 3 were too recent to report end-results. He claimed for this technic the production of a scar which yields readily to the forces of labor, making cesarean section unnecessary.

## DIAGNOSIS

As pointed out by Page, to select cases for operation two criteria are necessary: the proper obstetric history and the demonstration of a dilated internal os. There are endocrine factors in some late abortions; therefore, the history alone is not sufficient. There are also cases in which a dilated internal os can be demonstrated in which pregnancy goes to term. All observers agree that there should be a history of 2 or more late abortions or premature labors. It is doubtful whether abortions earlier than the 12th week can ever be attributed to an incompetent internal os. Rupture of the membranes without bleeding followed by a precipitate relatively painless labor is the typical history. Such a history should make one suspicious of cervical incompetency, but the investigation of the uterus should not be done until several months have elapsed since the last pregnancy. Then a 7-mm. Hegar dilator can be introduced through the internal os with little resistance and discomfort. Hystero-graphy should be done for two reasons: (1) to demonstrate the inadequacy of the internal os, if present, and (2) to demonstrate the presence or the absence of a septate uterus as a possible cause of the reproductive failures.

The incompetent internal cervical os now seems to be well established as the cause of pregnancy wastage in the middle and the early 3rd trimester of pregnancy. The problem still remains unsettled as to the best method of restoring cervical competency and as to the time of operation.

## CHOICE OF PROCEDURES

Page has summarized so well this question that the author has taken the liberty of quoting directly:

Assuming that a diagnosis of internal os incompetence has been established on the basis of both history and findings, and assuming that the patient desires to undergo some procedure which will improve her chances of bearing a viable child, what should be done? There are 4 possibilities: (1) A Palmer-Lash excision and repair of the anterior lower uterine segment; (2) the circular wrapping type of operation; (3) placing a purse-string suture of heavy non-absorbable material around the internal os during the first trimester of pregnancy; (4) waiting until the cervix actually dilates during pregnancy, and then closing it with the purse-string technic. The advantages and disadvantages of each approach may be briefly discussed.

#### WEDGE EXCISION AND CLOSURE

When a thinned-out defect can be clearly demonstrated in the anterior third of the lower uterine segment, this would appear to be the soundest anatomic approach. In the hands of Lash, the end-results have been satisfactory. Disadvantages would appear to be: (a) the possibility of wound disruption because of tension on the suture lines, (b) an apparent interference with subsequent fertility in some cases, and (c) the desirability of performing a cesarean section for delivery.

#### CIRCULAR WRAPPING AND SCAR PRODUCTION

The advantages of this procedure are: (a) There has been no indication to date of any interference with fertility; (b) the procedure strengthens the entire circumference of the cervix rather than one segment; (c) there is no possibility of wound disruption; (d) the scar yields readily to the forces of labor at term, and cesarean section is not necessary.

The disadvantages are: (a) The use of talc, as at present, produces a rosarylike series of tiny granulomas, rather than a smooth, thick keloid scar; (b) there is about a 30 per cent failure rate, although this approximates the failure rate of all other methods.

#### PURSE-STRING METHOD DURING THE FIRST TRIMESTER

This is the technic advocated by Green-Armytage of London (personal communication). The advantages are: (a) inasmuch as pregnancy now exists, there is no criticism of possibly interfering with fertility; (b) the technic is much simpler than attempting to close the cervix after it is dilated, as in the fourth method.

The disadvantages are: (a) Surgery on the uterus during early pregnancy might be fol-

lowed by abortion and this, rightfully or wrongfully, may be attributed to the operation; (b) if the patient should begin labor at home, and if the suture (polythene tube, Dacron mesh, heavy silk, or wire) were not cut in time, rupture of the uterus might occur.

#### CLOSURE OF THE DILATED CERVIX DURING PREGNANCY

This is obviously the method of choice if the physician is confronted with a patient whose cervix is dilating painlessly before fetal viability. It is also the procedure to adopt if one of the first 3 methods has been done and is now threatening to fail. To plan this method of therapy for the patient who is seen prior to pregnancy and in whom the diagnosis has been established would not appear to be in her best interests. This is because: (a) the optimal time for closure may readily be missed; and (b) the attempt is usually doomed to failure if labor pains have started, if tension within the bulging bag of waters is high, if the cervix is more than 4 cm. dilated, or if amnionitis is present. If this method should be adopted as a therapeutic plan and the patient loses her baby before the operation can be accomplished, this should be counted as a failure of the method.

#### TECHNIC: THE LASH OPERATION

The cervix is drawn toward the outlet with a tenaculum, and a semicircular incision is made through the anterior mucosa. The flap is dissected up, and the bladder dissected from the cervix until the vesicouterine peritoneal reflexion is seen.

A small Hegar dilator is placed in the canal, and a narrow retractor is used to hold back the flap and the bladder. The defect, anteriorly or laterally, is located by vision and palpation. It is excised.

The wound is closed with interrupted sutures of No. 1 chromic catgut with the Hegar dilator in place to prevent catching the posterior wall of the cervical canal. Closure is usually made in 2 layers. The mucosal flap is resutured with interrupted No. 0 catgut. A small gauze wick is placed in the cervical canal for 24 hours.

#### TECHNIC: SHIRODKAR-BARTER TYPE OF OPERATION

The operation as shown below is as done by Barter, using mersilene ribbon. The same technic may be used with fascia as advocated by Shirodkar.

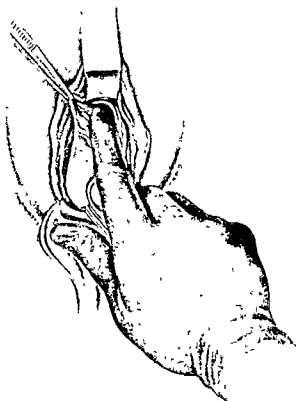
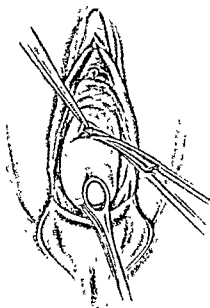


FIG. 197. (*Left*). A transverse incision is made through the vaginal mucosa at its junction with the cervix

FIG. 198. (*Right*) The bladder is advanced. This is necessary so that the ribbon suture may be placed high enough to be of value.

(Figs. 197 to 204 from Dr. R. H. Barter and the Ethicon Co.)

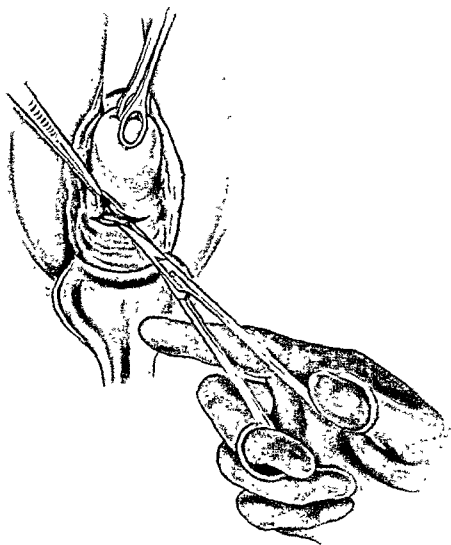


FIG. 199. A transverse incision is then made through the vaginal mucosa, posteriorly as it is reflexed onto the cervix

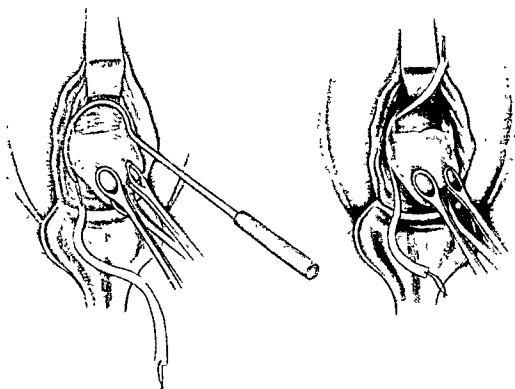
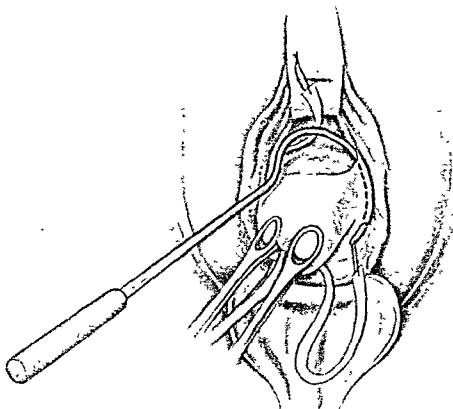


FIG 200. (*Left*) An aneurysm needle is introduced beneath the mucosa and is made to emerge posteriorly. The encircling ligature strip is then pulled upward under the mucosa on the right. (*Right*) Shows the ligature in place on the right side.



*FIG. 201 A mirror image aneurysm needle is then inserted on the left, and the other end of the ligature is brought anteriorly beneath the mucosa.*

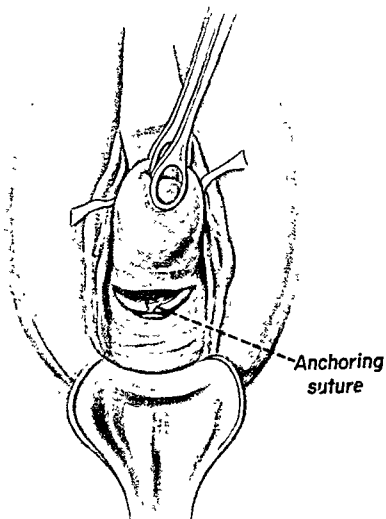


FIG. 202. Shows the ligature anchored posteriorly by 2 fine silk sutures.



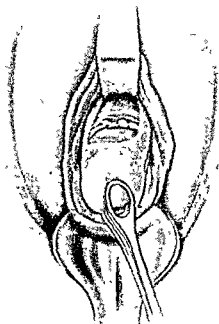


FIG. 203. (Left) Shows the encircling ligature in place, after having been looped once, pulled tightly to close the cervix. The cervix should not admit the tip of the finger after the ligature has been tightened. The ligature is anchored anteriorly with fine silk.

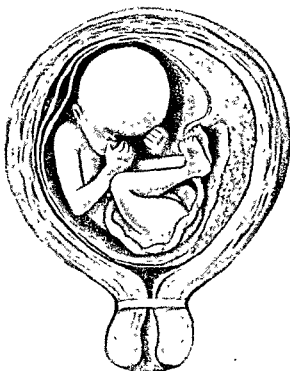


FIG. 204. (Right) Shows the level at which the encircling ligature should be at the completion of the operation.

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# Dilatation of the Cervix and Curettage of the Uterus

## DILATATION OF THE CERVIX

### INDICATIONS

Dilatation of the cervix is carried out as a preliminary step to curettage of the uterine cavity. As a therapeutic measure it is done for acquired or congenital cervical stenosis, for dysmenorrhea, for sterility in connection with the Rubin's test, to permit the introduction of intra-cervical and intra-uterine radium, and as a part of other operations on the cervix, such as trachelorrhaphy and amputation.

The reason for cervical dilatation in most of the procedures mentioned above is quite obvious. In connection with dysmenorrhea and sterility there is room for controversy, and a discussion of the subject is in order.

It is a recognized fact that many cases of dysmenorrhea are not cured by cervical dilatation. Because of frequent failures some gynecologists have almost abandoned it as a part of their therapeutic armamentarium. We do not subscribe to this totally pessimistic point of view. In most instances it is impossible to detect those cases of dysmenorrhea that will be relieved by cervical dilatation. Often the operation must be done as a therapeutic test, but fortunately it is such a minor procedure that one is justified in performing it on that basis. Those cases of dysmenorrhea that occur in parous women may be eliminated immediately. If the dilatation resulting from the birth of the child has not relieved the menstrual pain, surely surgical dilatation will not do so. In the nulliparous woman who suffers most during the latter days of her period there is little chance

of relief by dilatation. In the nulliparous woman who suffers most just before the onset of the flow or during the early part of the flow, there is a possibility of relief from cervical dilatation. However, this is by no means certain, for this history is the commonest of all in dysmenorrheic women, all of whom are not relieved by cervical dilatation. When acute ante flexion of the uterus is present, often there is an associated narrowing at the internal os, and dilatation gives relief in a fair percentage of such cases. There is no way of telling with certainty which women will experience relief and which will not. It is our clinical impression that about one third of the cases are relieved permanently of the greater part of their menstrual pain; one third are helped to some degree or temporarily with a gradual recurrence of pain after some months; and about one third receive no help whatever. We make it a rule to acquaint the patient with these facts before proceeding with the operation and permit her to come to her own decision as to whether or not her menstrual pain is sufficiently severe to justify an operation with this chance of success.

In sterility cases a slight dilatation of the cervix is usually necessary in nulliparous women in order to introduce the Rubin's cannula. Following the completion of the tubal insufflation it is our custom to dilate the cervical canal thoroughly. We believe that benefit can be derived from this and base our belief on two observations. Before the era of the Rubin's test, dilatation and curettage were done frequently for sterility. Although the results of this procedure were

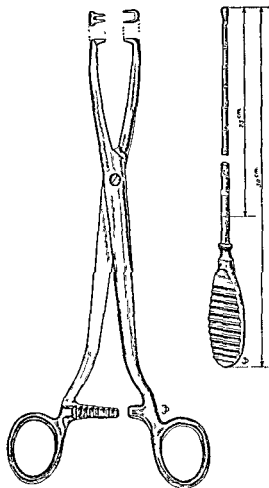


FIG. 205. (Left) Straight Jacobs clamp, used for pulling down cervix when performing curettage and for grasping cervix in doing subtotal hysterectomy. (Right) Uterine sound.

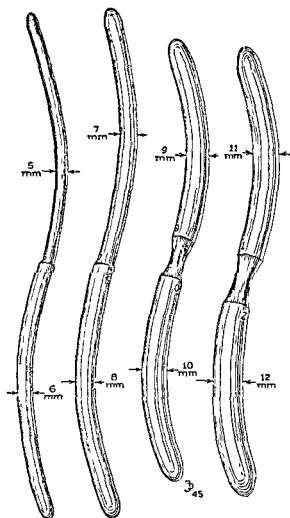


FIG. 206. Graduated Hegar dilators.

not as good as they are today by combining cervical dilatation with tubal insufflation, a certain percentage of the women with a long history of sterility became pregnant. Furthermore, one frequently sees pregnancy take place promptly after a Rubin's test when the tubes were found open at a very low pressure. It is our opinion that such results are probably due, in most instances, to the cervical dilatation rather than to the passage of gas through normally patent tubes.

#### TECHNIC: CERVICAL DILATATION

The patient is placed on the table in the lithotomy position, and the vagina and the perineum are cleaned up with the usual tech-

nic. The cervix is grasped with a 4-pronged tenaculum (Fig. 205, *Left*) and gently drawn to the outlet. A sound (Fig. 205, *Right*) is passed through the cervical canal into the uterine cavity. This gives one exact confirmatory information regarding the position of the uterus and of the angulation between the cervical canal and the uterine cavity. An idea of the degree of stenosis of the cervical canal can also be detected in this manner.

Dilating the cervical canal is begun with a small Hegar dilator (Fig. 206). The uterine wall may be perforated by the improper use of a Hegar dilator; usually this is due to lack, or disregard, of knowledge of the position of the uterus. When acute antelexion is present the dilator may per-

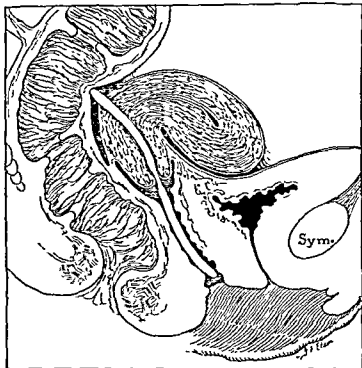


FIG. 207. Illustrating the possibility of puncture of the acutely anteverted uterus which was thought to be in retroposition, and the Hegar dilator was erroneously directed posteriorly.

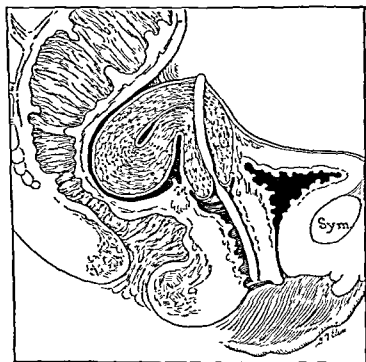


FIG. 208. Illustrating the possibility of puncture of the retroflexed uterus which was thought to be in anteversion, and the Hegar dilator was erroneously directed anteriorly.

forate posteriorly (Fig. 207). When retrodisplacement exists, the perforation usually takes place anteriorly (Fig. 208). It is rare that the dilator perforates the fundus except when there is a much-atrophied postmeno-

pausal uterus. After the small Hegar dilator is passed, successively larger ones are used. For ordinary curettage, dilatation to No. 8 or No. 9 Hegar suffices. When dilatation is done for dysmenorrhea or sterility, we prefer

to carry the dilatation up to No. 10, but this is not always possible. When the internal os is dilated with difficulty, we generally use the Goodell dilator also (Fig. 209), stretching the os until the Hegar dilator of the next larger size can be passed. The Goodell dilator is a powerful instrument, and it must be used carefully. The danger is less of perforation, as with Hegar dilators, but of splitting the side of the cervix. If this occurs and results in appreciable bleeding, the laceration should be sutured.

When dilatation of the cervix is done for removal of placental tissue, dilatation up to No. 11 and No. 12 Hegar is often necessary to permit the introduction of a large blunt curette and placental forceps. We seldom use the Goodell dilator on the soft pregnant or recently pregnant cervix because of danger of tearing it.

## CURETTAGE OF THE UTERUS

### INDICATIONS, CONTRAINDICATIONS AND ANESTHESIA

Curettage of the uterus is the most frequent of gynecologic operations and is generally regarded as a simple and harmless procedure. Like most simple procedures, it may be done correctly or incorrectly. Nor is it entirely devoid of danger. A curettage done under proper aseptic technic carries with it very little risk, but if proper precautions are disregarded, complications, and even death, may result.

The chief purpose of curettage of the uterus is the removal of endometrial or endocervical tissue for histologic study in those cases in which there has been abnormal uterine bleeding. Thus, a diagnosis of endometrial carcinoma may be made or excluded. When the bleeding is of a functional nature, a knowledge of the type of endometrium is of value in future therapy; in sterility cases a curettage done premenstrually will give definite information regarding ovulation during the current month. Curettage of the cervical canal is indicated when carcinoma of the endocervix is suspected in the intact uterus, or when bleeding takes place from a cervical stump.

In some instances curettage may be of great value therapeutically. The benefit to

be derived from curettage in functional bleeding is discussed under that heading. Certainly, it is of great value for the temporary relief of profuse functional bleeding. The endometrial polyp (Fig. 210) may be removed successfully by the curette or by polyp forceps, and it is our opinion that many cases of so-called functional uterine bleeding,

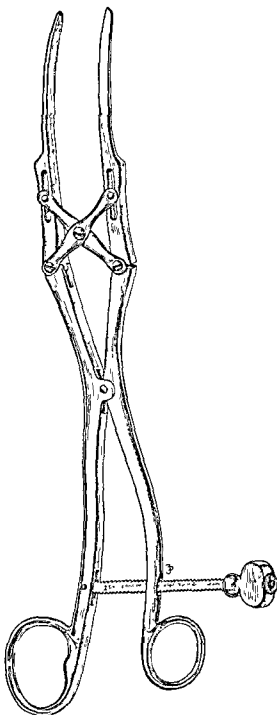


FIG. 209. Goodell dilator.

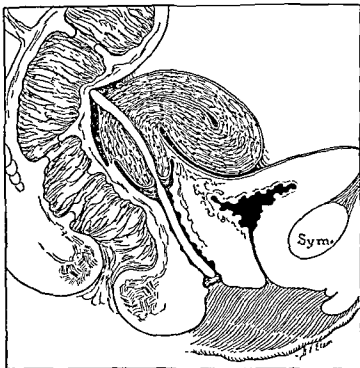


FIG. 207. Illustrating the possibility of puncture of the acutely anteфлекed uterus which was thought to be in retroposition, and the Hegar dilator was erroneously directed posteriorly.

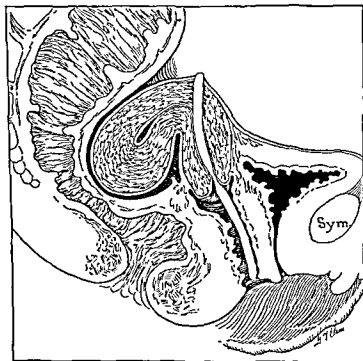


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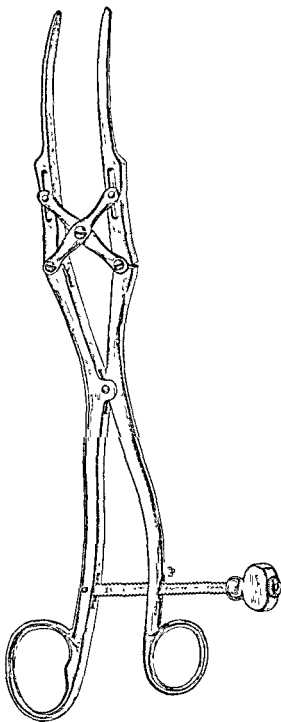


Fig. 209. Goodell dilator.

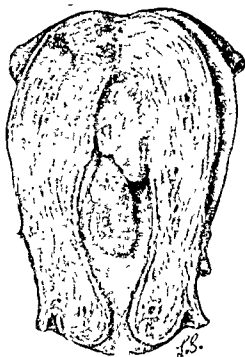


FIG. 210. Opened uterus, showing 2 separate endometrial polyps.

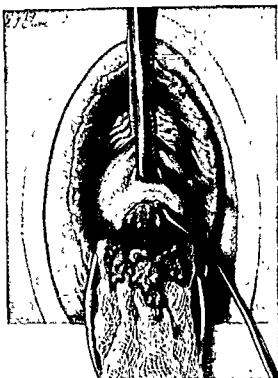


FIG. 211. Method of collecting curettings and blood on gauze.

which are cured permanently by a single curettage, are actually instances in which a polyp was removed by the curette. One of the chief therapeutic uses of the curette is the removal of retained placental tissue following abortion or full-term delivery.

The chief contraindication to curettage is infection. Acute cervicitis, acute salpingitis and acute vaginitis all constitute conditions under which curettage should be avoided. Curettage of the infected endometrium should be avoided also, but at times it must be done for the removal of retained placental tissue. Indeed, the endometritis associated with retained products of conception will fail to get well until the foreign material is cast off spontaneously or is removed by the curette. Frequently, curettage must be done through a chronically infected cervix, and this is a safe procedure if proper precautions are taken to sterilize the vagina and the cervical canal.

Pentothal Sodium is the anesthetic that we have used for curettage almost exclusively during the past several years. It is rapid in action, approaches almost complete safety

if used properly, and recovery from it is almost entirely devoid of unpleasant effects. Of course, cyclopropane or nitrous oxide may be added at the discretion of the anesthetist. Also, relaxing agents may be used when further relaxation is necessary for a proper examination under anesthesia. On rare occasions, in feeble old women who have required curettage for postmenopausal bleeding, we have performed the operation with no other anesthetic than hypodermic administration of an H.M.C. tablet.

#### TECHNIC: CURETTAGE OF UTERUS

After anesthetization the patient is put in the lithotomy position, and the vagina is cleaned up with the usual technic. The cervical canal is then swabbed out with a small cotton pledget soaked in alcohol. This little refinement in technic we believe to be important, for the cervical canal is open to the flora of the vagina, and no matter how thoroughly the vagina may be cleaned up, the cervical canal remains contaminated unless special attention is given to it. The cer-



vical canal is dilated with Goodell and/or Hegar dilators as described in the previous section. A dilatation up to No. 9 or 10 Hegar is sufficient for the usual diagnostic curettage. Then the uterine cavity is sounded in order to get an idea of its size and to confirm the impression of its position as received from examination under anesthesia. A gauze sponge is placed within the vagina along the posterior retractor so that the blood and the endometrium removed from the uterus may fall upon it (Fig. 211). A small bluntly serrated curette (Fig. 212) is then introduced into the uterus, and in a systematic manner the entire uterine cavity is curetted. The anterior, the posterior and the lateral walls are scraped gently but firmly, and finally the top of the cavity is scraped with a side-to-side movement (Fig. 213). The cervical canal should be curetted also if there is any suspicion of its being the site of malignancy or polyps. The unclotted blood is absorbed quickly by the gauze sponge, leaving the relatively clean endometrium to be placed in the small, wide-mouthed, sterile bottle that is always on the instrument table. Fixative is poured over the curettings immediately, and the specimen is sent to the laboratory.

FIG. 212. Small serrated curette for routine curettage.

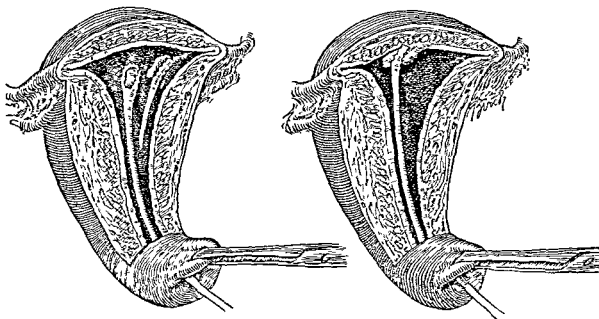
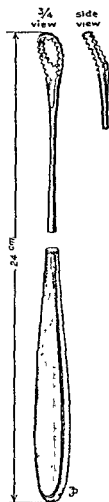


FIG. 213. Method of curetting uterine cavity systematically. (Left) Anterior, posterior and lateral walls of cavity are curetted systematically. (Right) Then the top of cavity is curetted thoroughly.

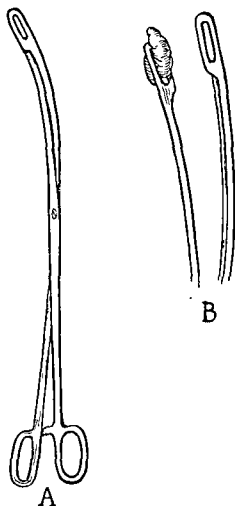


FIG 214. (A) Ureteral stone forceps, an excellent instrument for removal of endometrial polyps. (B) Shows polyp which was missed at curettage, grasped in forceps

In addition to scraping the uterus, the curette is useful in exploring the uterine cavity for irregularities in its contour, such as may be caused by a submucous fibroid. In this way one may discover small fibroids that are entirely undetectable through bimanual palpation. Also in our clinic it has become a routine procedure to biopsy the cervix thoroughly whenever a curettage is done. This is discussed further in the chapter on carcinoma-in-situ.

During the past 10 years we have made it a rule to explore the uterine cavity with a forceps at each curettage. One of the easiest

things to do is to miss an endometrial polyp with an ordinary curette. As a result, many unnecessary hysterectomies have been done because of supposed persistent or recurrent functional bleeding following a curettage. By means of the routine use of the polyp forceps such operations may be avoided. During a 28-month period on our service during which the forceps were used routinely, Josey found that the diagnosis of endometrial polyp was made 130 times. In 83 of these cases the polyp was removed by forceps (Fig. 214). Although the sessile form of submucous myoma is diagnosed easily by noting an irregularity of the uterine wall with the curette, the pedunculated variety, like the endometrial polyp, may escape detection because of its narrow stalk. Often such fibroids may be grasped with the polyp forceps. Likewise, often a congenital septum may be detected with the forceps.

When curettage is done as a curative measure for removal of placental tissue, a large, blunt, smooth curette is used to lessen the chances of perforation. The larger and softer the uterus, the larger should be the curette used and the more careful should one be to avoid perforation. When large masses of placental tissue are present, the placental forceps are most useful when used in conjunction with the curette. Uterine packing is rarely required for curettage, except when the curettage is done for retained placental tissue; then bleeding may necessitate packing with a 1- or 2-inch gauze pack, depending on the size of the uterus. Such a pack may be moistened and then sprinkled with sulfanilamide crystals before it is packed in the uterine cavity; it should be removed in 24 hours.

#### PERFORATION OF THE UTERUS

If the position and the consistency of the uterus are carefully noted through bimanual examination under anesthesia before curettage is undertaken, perforation will rarely occur. When the position of the uterus is not known to the operator, perforation may occur with remarkable ease. Also in the senile atrophic uterus perforation may be done with extremely slight force of the sound or the curette. Perforation is discovered by failure of the sound or the curette to encounter re-

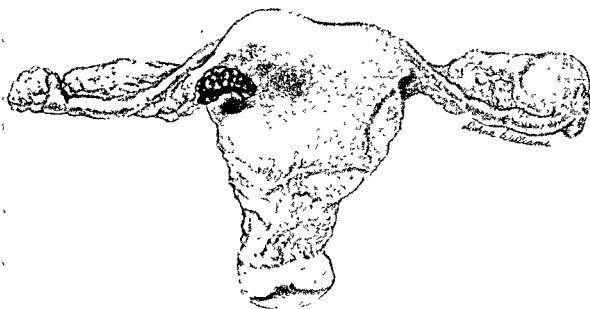


FIG. 215. Demonstrating result of punctured uterus. Specimen removed directly after puncture.

sistance at the point that it normally should do so, as judged by the palpated size of the uterus.

Perforation of the uterus by a small curette in performing an ordinary diagnostic curettage is usually not a serious accident. Curettage may not necessarily be stopped, but one should avoid that part of the cavity at which the perforation occurred. The patient should be watched carefully for signs of hemorrhage or infection. If signs of hemorrhage develop, the abdomen should be opened and the uterine wound sutured. If signs of infection develop after operation, penicillin therapy should be intensified and fortified with streptomycin. The patient should be watched for localization of the infection. If this occurs, the abscess should be drained. It is a rarity for either serious hemorrhage or infection to occur. Figure 215 shows a uterus removed immediately after a perforation. This uterus was removed because the

gross character of the curettings indicated malignancy. There was only a small blood clot found at the site of the perforation. Recently, Word *et al.* analyzed 70 accidental uterine perforations. Among these, 7 unplanned hysterectomies were done on unprepared patients. In none did the findings in the peritoneal cavity warrant hysterectomy. In fact, it only compounded the error. Fifty-five patients were treated conservatively, and only one developed a complication in the form of a pelvic abscess which was drained by colpotomy.

When perforation of the large, boggy, postabortal or puerperal uterus is done by a large curette or placental forceps in removing placental tissue, there is danger of injury to gut, prolapse of gut into the wound, hemorrhage and/or infection. The treatment that should be given and the procedures that should be followed are discussed in Chapter 30, which deals with abortions.

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# Cancer of the Cervix Uteri

## PROPHYLAXIS

The old adage concerning prevention and cure holds especially true when we are concerned with malignant disease in which the percentage of cures is not high. Invasive carcinoma of the cervix falls into this category. Since the cervix is an organ that may be palpated and inspected directly, it lends itself to prophylaxis or exceedingly early detection of malignant disease much better than the internal viscera.

In earlier editions of this book it was stated that the routine annual examination of the cervix of all women over 30 was a utopia but a goal difficult of achievement. We have by no means attained that goal, but great progress has been made in the last decade. There are still many physicians who through ignorance or indolence fail to make proper examinations to detect early cervical cancer. There are still many women who through ignorance, fear or the natural inclination to procrastination fail to have an annual checkup. Since the 1st and the 2nd editions of this book much work has been done and published on the subject of carcinoma-in-situ. In our clinic, for example, in the decade from January 1, 1950, through December 31, 1959, we have treated a total of 1,217 cases of cervical cancer, and 350 of these have been in situ (28.8%).

There are few doctors who do not know that the first sign of cervical cancer is usually intermenstrual or postmenopausal bleeding, yet many fail to make the necessary examinations to determine the condition of the cervix on each and every woman who presents herself with bleeding.

As a result of education of the lay population and doctors, gynecology has become in a large measure preventive medicine. A large proportion of the better-educated women do

come to their physicians for regular annual checkup examinations when they are entirely asymptomatic, and this accounts for the fact that the lesions are constantly appearing at an earlier stage. This is chiefly responsible for our better therapeutic results.

The necessary examinations are few and relatively simple: inspection of the cervix and taking a cytologic smear, palpation of the cervix and biopsy of any suspicious areas. These examinations are sufficient often to rule out or make a definite diagnosis of cervical malignancy. In many instances, a more thorough investigation is necessary to learn the extent of the lesion; but if the above-mentioned simple examinations are made in the physician's office, very few cervical malignancies will be overlooked.

The failure of many practitioners to make proper examinations has been responsible for an experiment in cancer detection centers in many localities throughout the United States. Many of these, under the sponsorship of the various state divisions of the American Cancer Society, have been in operation for several years with varying success. In Maryland we have detected unsuspected cancer in 0.5 per cent of the persons examined. Cervical cancer was detected in 0.2 per cent of the women examined. The incidence of unsuspected cervical cancer is probably considerably greater than this in the general female population, since the great majority of women applying for examination at the detection centers were Hebrew, a race particularly nonsusceptible to cervical cancer. Such detection is very costly—\$3,468 per detected case in the Maryland centers.

A study made in Franklin County, Ohio, on 60,184 women over 20 years of age is most illuminating as to what can be accomplished. Utilizing proper publicity means, the

women of the county were offered free cytologic examinations over a period of 2 years. The change in the clinical material resulting from this study is illustrated in the following chart. The 1957 data illustrate the improvement at the University Hospital after this extensive use of cytology:

CLINICAL STAGE	1947	1957
0	0	38%
I	14%	48%
II	41%	5%
III	41%	7%
IV	4%	2%

The chart at the bottom of the page illustrates the improvement in material at the Johns Hopkins Hospital, due probably chiefly to education and cytology.

#### RELATION OF CERVICITIS AND PARITY TO CARCINOMA

No one ever has proved conclusively that cervicitis predisposes to cervical cancer, but there is evidence that points in that direction. The work of Pemberton and Smith in following up groups of women who had been treated by various methods for chronic cervicitis suggests that the eradication of infection is prophylaxis against subsequent malignancy. These observers reported that none of 1,408 women whose cervixes were cauterized in their clinic was known to have developed cervical malignancy. Likewise, none of the 740 women who underwent cervical amputation was known to have developed, subsequently, carcinoma of the remaining portion of the cervix. Five of 3,814 women upon whom trachelorrhaphy was done were known to have developed carcinoma subsequently. It is at least suggested by the above study that the removal or the destruction of chron-

ically infected cervical tissue may be effective in preventing subsequent malignancy. It is to be noted that after trachelorrhaphy 5 women were known to have developed cancer, in contrast with the absence of evidence for subsequent malignancy after cauterization or amputation. This might be expected, since trachelorrhaphy simply removes the tissue about the old scar and may invert considerable infected tissue into the cervical canal. From our study of early cervical cancer it is obvious that the region at or near the external os is the most vulnerable point for the origin of cancer. It appears, then, that an operative procedure which removes or destroys diseased tissue at that portion of the cervix should be the best measure to prevent carcinomatous development. Cauterization, conization and cervical amputation do this most effectively.

In 1950 Professor Gagnon, of Quebec, brought to the attention of the profession an interesting observation concerning the incidence of carcinoma of the cervix in nuns. He had been gynecologist to certain Quebec nunneries for several years, and it occurred to him that he never had seen a case of cancer of the cervix in a nun. Among 13,000 deaths of nuns there were none recorded as due to cervical cancer. During this same period of time there were 12 deaths recorded as due to corpus cancer. If the same ratio of carcinoma of the cervix to corpus cancer exists among nuns as among the general population there should have been 5 to 8 times as many cervical cancers. Instead there were none. This suggested to Gagnon that the extremely low incidence of cervicitis among these celibate women might be the important factor in the low incidence of cervical cancer. Gagnon is extending his work in this field, and his findings to date give further credence to the view that cervicitis predisposes to cancer.

In spite of these interesting observations

YEAR	I.C. 0	I.C. I	I.C. II	I.C. III	I.C. IV	TOTAL CASES
1942	4	14	8	15	13	54
1947	17	20	32	16	7	92
1952	22	14	15	12	4	67
1957	22	15	8	8	2	55
1959	35	33	9	7	1	85

concerning cervicitis there is little evidence that cervical lacerations due to childbirth predispose to carcinoma.

In connection with a consideration of cervicitis and carcinoma it might be appropriate to comment on the fact that cervical cancer is extremely rare among Jewish women. For example, Brzezinsky and Bromberg found no cases of cervical cancer among 187 Jewish women with postmenopausal bleeding. This has been attributed to the fact that Jewish males have been circumcized; hence, their sex organs are cleaner and less apt to transmit infection to the cervix. Such an opinion has been expressed in a publication from the University of Jerusalem after making a study on the incidence of cervical cancer in their Jewish female population which had been gathered in from practically all parts of the world. In the opinion of this writer, such a conclusion is not justifiable, for the Arabs also have a religious ritual circumcision, and cervical cancer is as common in them as in the non-Jewish population throughout the world. After reviewing the pertinent facts it appears to this writer that the reason for the immunity of Jewish women to cervical cancer remains unknown.

Great skepticism has been aroused by the results of Hinselmann's work. There is the widest divergence of opinion on the percentage of nulliparous women among victims of cervical carcinoma. One can find in the literature figures varying from 2.8 to 40 per cent. From surveying many statistical studies it seems probable that the average incidence lies in the neighborhood of 10 per cent. But that figure has no significance unless we know what percentage of women in the cancer age are nulliparous. Hinselmann found that approximately 10 per cent of the female population of Prussia over 35 years of age were unmarried. He assumed that the parous unmarried women approximately equalled the sterile married women. Hence, the conclusion was reached that approximately 10 per cent of women in the ages in which cervical cancer commonly occurs were nulliparous, and this figure is practically the same as that of the incidence of nulliparous women among those with cervical cancer. If these figures are correct (and they seem to be reasonable), it appears that parity and cervical lacerations

may not be a great factor in the etiology of cervical cancer and perhaps no factor at all.

## THE DIAGNOSIS

In this section the diagnosis of gross lesions only is to be considered. Diagnosis of the macroscopically invisible lesions is considered in Chapter 23, "Carcinoma-in-Situ of the Cervix." The gross lesion may often be suspected and *almost* diagnosed from simple palpation of the cervix. To the palpating fingers the carcinomatous growth may be friable, as is usually the case with the evert-ing type of growth. It may have a stony hard but smooth feeling when the growth develops beneath normal mucosa. The lesion may take the form of a punched-out ulcer, or the cervix may feel quite normal when a relatively extensive lesion exists in the cervical canal.

To inspection, the friable lesion appears like a roughened, granular, bleeding surface which may be sloughing, infected and foul smelling. The ulcerative lesion may appear like a fairly clean punched-out ulcer, or there may be a craterlike excavation with a necrotic base. Rarely, a growth starting in the cervical canal may protrude from the external os much like a benign polyp. The stony hard cervix that is the site of an extensive growth beneath relatively normal mucosa may not appear very abnormal, even when the growth is quite advanced. The inverting type of growth may extend well into the musculature of the cervix without changing the appearance of the vaginal portion of the cervix as viewed through the speculum. The important point is that every suspicious-feeling cervix should be inspected through a speculum with good visualization, and that every cervix should be visualized when there has been abnormal bleeding, even though it feels entirely normal to palpation.

Having suspected the cervical lesion, it always should be smeared and biopsied. The most "typical" appearing lesion may not prove to be carcinoma. We have seen tuberculous lesions of the cervix as well as other granulomas which could not be distinguished grossly from cancer. Furthermore, the diagnosis must be verified microscopically to permit the case to be included in the 5-year salvage reports.

Biopsy of the cervix can be done in several different ways. There is no better method of making satisfactory biopsies than to excise wedge-shaped pieces of tissue with a scalpel, including the surface and some of the sub-jacent tissue. There are numerous biopsy instruments on the market, but we have found the Gaylor forceps to be of great value in taking biopsies in the office, the outpatient department and the operating room (Fig. 216). Conization of the cervix seldom is necessary when a gross lesion is present. It is done routinely in our clinic in evaluating microscopic cervical cancer and the reader is referred to Chapter 23, "Carcinoma-in-Situ of the Cervix." However, curettage of the cervical canal is frequently done in the presence of gross cervical cancer to determine the extension of the lesion up the canal. The information thus obtained is of value in planning the irradiation therapy.

The tissue is dropped in alcohol, formalin, or Vande Grift's solution and sent to a reliable laboratory for diagnosis. Because we have found the fixation with Vande Grift's solution superior to any other, the formula is given below:

Formalin (full strength)	12 cc.
Ethyl alcohol 75%	80 cc.
Glacial acetic acid	45 cc.

Mix the above 3 solutions and add each of the following separately. Dissolve each completely and as quickly as possible. Add the next. *Do not permit the picric acid to stand in solution long before adding the urea.*

Picric acid (dry)	4.0 Gm.
Mercuric chloride	0.2 Gm.
Urea	0.5 Gm.

101.2 cc.

Because the changes in the biopsies may be of the finest histologic type, the best possible sections should be utilized for study. For this reason we never use frozen sections. In slightly over 24 hours an excellent paraffin-embedded and well-stained section can be made, and this slight delay is of no importance. It never has been shown that the lapse of a short interval of a few days between the time of the cervical biopsy and subsequent treatment affects the prognosis adversely.

## CYTOLOGIC DIAGNOSIS

Since Papanicolaou demonstrated the possibility of the diagnosis of malignancy by the study of individual cells in smears made from exfoliation of cancerous tissue, gynecologists have shown great interest in this technic for the diagnosis of cervical cancer. Because the cervix is essentially a surface organ, and since its exfoliated cells lie within the vagina, it lends itself to cytologic examination better than most organs. Sufficient time has now elapsed since Papanicolaou's original discovery to have permitted a wide experience with this technic and an evaluation of its worth.

At the outset it should be stressed that the interpretation of smears should be made only by trained cytologists. Even capable cellular pathologists, without special training in

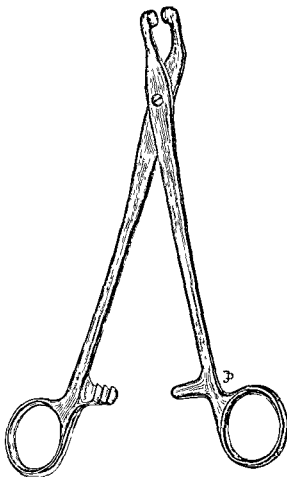


FIG. 216. Gaylor biopsy forceps, a most useful instrument for biopsying cervixes in the office and the operating room.

cytology, are not competent to interpret smears. The practice of some doctors, without special training, of making and reading smears in their offices is to be condemned and can lead only to errors for which the patients may pay dearly.

It is doubtful whether many readers of this book will attempt to qualify as cytologists, but a superficial description of the cell changes on which the diagnosis of malignancy is made is in order. Plates 1 and 2 show normal vaginal cells. Plate 3 shows a typical vaginal smear of cervical malignancy. Some of the changes in the individual cells indicative of malignancy are: an increase in the size of the nucleus in relation to the cytoplasm, and increase in the chromatin content of the nucleus, fragmentation and irregularity of the nucleus and the prominence of nucleoli. At times typical mitoses in various phases are seen in the abnormal cells. When clusters of cells are present, loss of normal pattern and overcrowding of cells are often seen. It is obvious that these cellular changes require careful study for their detection under both low-power and high-power magnification. Papanicolaou has classified the smears into 5 groups:

1. Essentially normal epithelial cells
2. Cells atypical in cytoplasmic or nuclear details (or both), but no cancer cells present
3. Cells strongly suggestive of malignancy but upon which a definite diagnosis of cancer cannot be made
4. Malignant cells present, but few in number or kinds (or both)
5. Many cancer cells present, often of many kinds

It is obvious that a personal equation enters into this classification but, in general, it is very useful.

For practical purposes we have chosen to simplify the classification into negative, positive and suspicious. The results in our clinic are shown in the following tabulation.

#### ANALYSIS OF SMEARS

Total number of smears and biopsies	2,321	
Smear negative; biopsy benign	1,939	
Smear positive; biopsy carcinoma	79	
False-positive smears	27	1.1%
False-negative smears	17	0.73%
Doubtful smears	179	3.3%
Unsatisfactory smears	78	
Positive smear (negative biopsy incorrect)	2	

From the above chart it will be seen that the percentage of error of positives and negatives is very small, but what can be said of the doubtful smears? An analysis of this group shows that in 25 per cent biopsy eventually showed carcinoma or basal-cell hyperactivity. Simply stated, this means that a suspicious or doubtful smear, often indicates some abnormal cellular activity within the cervix and calls for continued observation over several months with repeated smears and biopsies.

When an analysis is made of the smears and the biopsies of proved gross carcinoma cases and the percentage is figured on that basis, the error in the smears becomes much larger, but the percentage of error of the biopsies remains small.

#### ANALYSIS OF PROVED GROSS CARCINOMA CASES

		PER CENT
Total number proved carcinomas	130	100
Smear positive	82	63.1
Smear doubtful	25	19.2
Smear negative	17	13.1
Smear unsatisfactory	6	4.6
Biopsy negative	2	1.5

The percentage of error in carcinoma-in-situ is extremely small, much smaller than when dealing with gross cancer. This is because the cells shed from the microscopic lesion are better preserved and not mixed

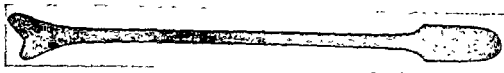
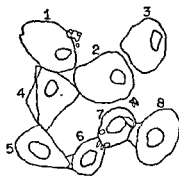
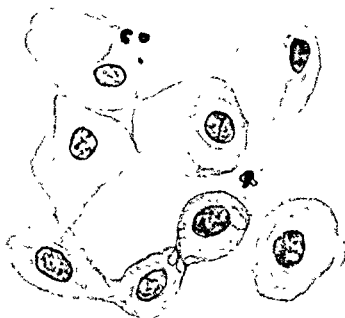


FIG. 217. Ayre wooden spatula.



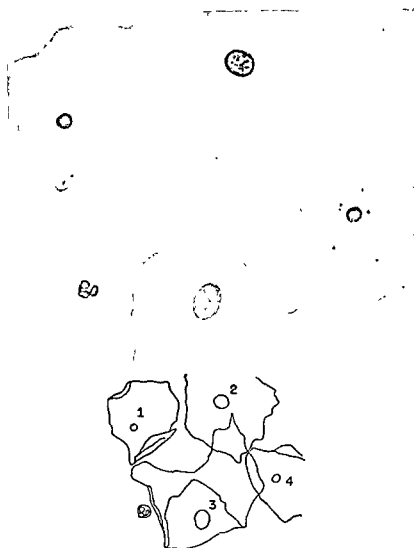
# PLATE I



## KEY TO BASAL CELL PLATE

1. Outer layer basal, vesicular nucleus, thin transparent cytoplasm.
2. Outer layer basal, finely granular nucleus, unevenness in density of cytoplasm.
3. Outer layer basal, degenerate, partially pyknotic nucleus, perinuclear vacuole.
4. Early precornified cell, showing square shape and folding of transparent cytoplasm.
5. Outer layer basal, oval nucleus, cellular form slightly elongated.
- 6 and 7. Inner layer basals, dense cytoplasm showing beginning of vacuolization, round vesicular nuclei.
8. Outer layer basal, with central nucleus containing finely divided chromatin. (The Cytologic Diagnosis of Cancer, Philadelphia, Saunders)

# PLATE 2

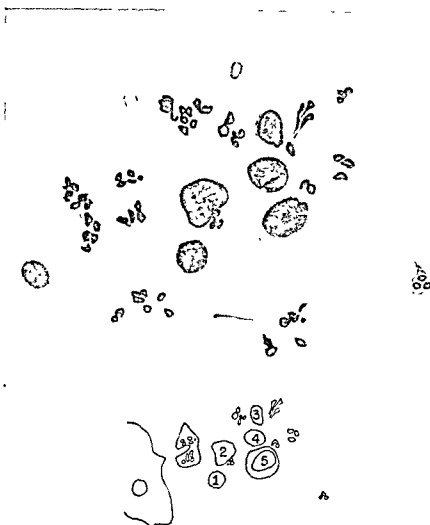


## KEY TO CORNIFIED AND PRECORNIFIED CELL PLATE

1. Flat cornified cell with pyknotic nucleus and fairly even cellular border.
2. Precornified cell showing wrinkled, transparent cytoplasm and a vesicular nucleus.
3. Precornified cell with large amount of folded transparent cytoplasm and bland nucleus.
4. Cornified cell with small dense nucleus, irregular cytoplasm with granules and evidence of a perinuclear vacuole.

(The Cytologic Diagnosis of Cancer, Philadelphia, Saunders)

# PLATE 3



## KEY TO UNDIFFERENTIATED CELL PLATE

1. Round, undifferentiated malignant cell with a clear nuclear border, strands of chromatin and no visible cytoplasm.

2. Large, triangular-shaped undifferentiated cell showing prominent clumps of chromatin and a sharp nuclear border.

3. Undifferentiated cell with two obvious clumps of chromatin. This nucleus is smaller than the rest. There is no cytoplasm.

4. Slightly irregular, but definite nuclear border. Coarse clumps of chromatin and no cytoplasm.

5. Undifferentiated cell with a dense hyperchromatic nucleus and a small amount of cytoplasm with an indistinct cell border. The rest of the field contains cornified and precornified cells and leukocytes. (*The Cytologic Diagnosis of Cancer*, Philadelphia, Saunders)

with much degenerating cellular debris. Therein lies the great value of cytology, for the grossly invasive lesion can usually be visualized and biopsied under vision, making cytology unnecessary, whereas the pre-invasive lesion is not discernible to the naked eye.

**Method of Taking Smears.** For the taking of the smear we use the Ayre wooden spatula shown in Figure 217. Formerly we took two smears from each patient: one from the posterior fornix and one from the surface of the cervix. In the interest of saving the cytologist's time, in recent years we have combined these smears into one. The spatula first scrapes the posterior fornix and then the cervix, thus mixing the cellular debris of both areas before placing the smear on the slide. One end of the Ayre spatula has a projection for the purpose of inserting into the cervical canal and effecting rotation. Theoretically, this appears to be excellent, and sometimes it works in practice; but often the external os is not sufficiently patulous to permit introduction of the spatula into the canal, in which case one must be satisfied with rubbing the surface of the cervix. After transferring the material to the slide, it is dropped into a bottle containing equal parts of 95 per cent alcohol and ether. The bottle is sent to the laboratory.

**Economics of Cytology.** Not the least important phase of cytologic cancer detection is the economic one. Most of the cytologic laboratories up to the present time have been especially endowed and thus able to function without giving too much thought to a balanced budget. Careful examination of the smears is tedious and requires an average of 20 minutes per patient. In doubtful cases much more time is required. In our clinic we process and study approximately 4,000 cervical biopsies a year. To study these requires about 1 hour a day of our pathologist's time. To examine an equal

number of smears would require the full time of a trained cytologist. Hence, considering the cost only, detection by biopsy is much cheaper than by smear. If the smear technic were used to screen a large segment of the general population, a tremendous army of trained cytologists would be required, and the cost would be fantastic. From the standpoint of public health and early cancer detection in the general population the economic side of the question is an interesting one for speculation.

#### SUMMARY

The most severe test of cytologic diagnosis lies in its ability to detect cervical cancer in its subclinical stage, such as carcinoma-in-situ and microscopically invasive carcinoma. After all, gross lesions almost always give rise to symptoms, and for their detection it is necessary only to teach the doctor to make a bimanual examination and a speculum examination and to biopsy the gross lesion. But the microscopic lesion is usually asymptomatic and therefore presents a real challenge to this technic. In one respect the early lesion has an advantage over the advanced one for detection by smear. The neoplastic cells cast off are better preserved and hence more easily detected than those from the sloughing infected advanced growth. A lesion which is not grossly visible can easily be missed at biopsy. The smear has the advantage over the biopsy in that it is a representative sample of cells from the entire cervix. The published results of practical experience are somewhat variable as to the accuracy of the cytologic technic in picking up microscopic lesions. The table at the bottom of the page shows the results of cytologic studies in 4 clinics in which there has been a special interest in cytology as applied to carcinoma-in-situ.

From this table it is obvious that cytology is important and reasonably accurate in de-

AUTHOR	YEAR	NO. OF CASES	NO. OF POSITIVE REPORTS	NO. OF NEGATIVE REPORTS
Papanicolaou and Traut	1943	7	7	0
Foote and Li	1948	18	14	4
Graham and Meigs	1949	40	35	5
Younge et al.	. . . 1949	18	14	4

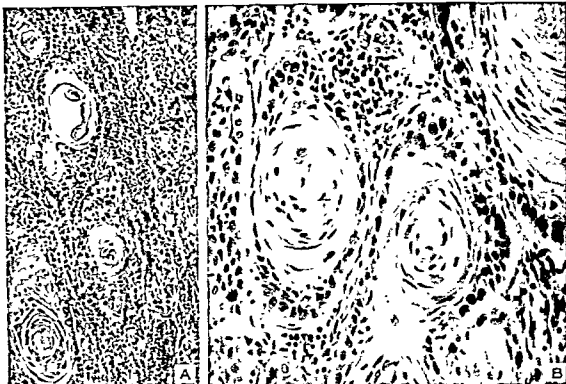


FIG. 218. Epidermoid carcinoma of the cervix. (A) Low power of spinal-cell type. (B) High power of same.

tecting preinvasive cervical cancer. It is, then, in the detection of asymptomatic microscopic cancer that cytology has its greatest usefulness. It can be predicted that if cytology attains such general use and if all women over 40 have an annual smear, invasive cervical cancer will become a rarity. Since it is of greatest importance in the very early lesions, the procedures which should be carried out to make an exact and certain diagnosis following the report of a positive smear are discussed in full in Chapter 23, "Carcinoma-in-Situ of the Cervix."

## CLASSIFICATIONS

### MICROSCOPIC

The microscopic classification of cervical carcinoma is of some importance in relation to treatment, and the clinical classification, based on the extent of the lesion, is of major importance in considering treatment and evaluating results.

In 1923 Martzloff made a histologic and clinical study of carcinoma of the cervix

based on the material in the gynecologic pathology laboratory of the Johns Hopkins Hospital. He found that epidermoid cancer of the cervix could be divided into 3 morphologic groups, dependent upon the predominant cell type. He designated these groups as spinal-cell, transition-cell and fat spindle-cell cancer. In the spinal-cell type of cancer the predominating cells resemble those polyhedral cells of the upper part of the stratum mucosum of ordinary cervical epithelium. Epithelial pearl formation occurs in some but not in all growths of this type (Fig. 218). The predominating cell of the transitional-cell cancers resembles those of the intermediate zone of cervical epithelium situated between the spinal layer above and the basal layer below. These cells are closely packed and have round nuclei that are separated from each other by cytoplasm deeper in staining properties and less in quantity than in the spinal cells (Fig. 219). The fat spindle-cell type of cancer has, predominantly, the fat spindle cells which morphologically resemble the basal cells in the stratum ger-

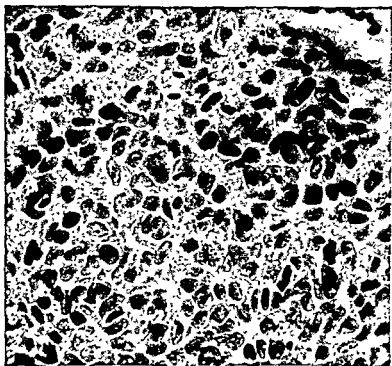


FIG. 219. Epidermoid carcinoma of the cervix. Transitional-cell type.

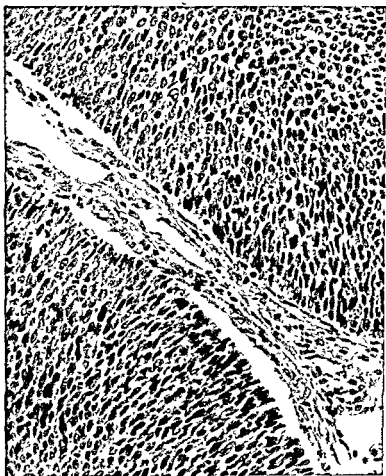


FIG. 220. Epidermoid carcinoma of the cervix. Fat spindle-cell type.

minativum of the cervical epithelium. These cells have dark hematoxylin-staining nuclei with scanty eosin-staining cytoplasm (Fig. 220).

On studying the operative results, Martzloff, judging by the percentage of clinical operative cures, showed that the spinal-cell type of cancer was the least malignant; the fat spindle-cell type was the most malignant; and the transitional-cell type occupied an intermediate position. Adenocarcinoma of the cervix was intermediate in its degree of malignancy between the spinal-cell and the transitional-cell type.

From the radiologic point of view, it appears that the reverse is true; spinal-cell cancer is the least radiosensitive. The fat spindle-cell type is the most sensitive to irradiation, while the transitional-cell type of cancer occupies an intermediate position in its radiosensitivity.

It was thought that the above facts might be put to some practical clinical value in deciding on the type of therapy to be directed at a tumor. Many other factors should also affect this decision, but now that surgical treatment is being reconsidered in some clinics it is probable that the predominating

cell-type of the tumor may influence gynecologists in selecting therapy. However, the value of this knowledge as influencing treatment is partially nullified by facts brought out in a second paper of Martzloff in which he compared the predominating cell found in the biopsied specimen with that found in the parent tumor. In about one third of the material studied (70 cases) the biopsy failed to indicate correctly the predominating cancer cell in the parent tumor. In addition to the epidermoid cervical carcinomas there are the adenocarcinomas which comprise 3.8 per cent of the cervical neoplasms in our clinic (Fig. 221).

#### INTERNATIONAL CLASSIFICATION

It is generally agreed that the gross extent of the growth is more important in relation to therapy and prognosis than the microscopic-cell type. In 1937 the Health Organization of the League of Nations adopted a gross classification which has been in general use abroad and in most of the clinics of the United States. In 1950 this classification was simplified and modified to include preinvasive cancer. No alteration of the basic principle of the League of Nations



FIG. 221. Adenocarcinoma of the cervix.

Classification was made, but the appearance of preinvasive cancer on the clinical horizon made it necessary to add another stage which was designated as Stage 0. The necessity of making a separate class for the preinvasive lesions became apparent when reports of 5-year salvage began to appear in the literature which included the preinvasive lesions with the Stage I. Obviously, such results could not be fairly compared with previous results before the recognition of the preinvasive lesions.

The following is the International Classification:

Stage 0. Carcinoma *in situ*—also known as preinvasive carcinoma, intra-epithelial carcinoma—and similar conditions.

Stage I. The carcinoma is strictly confined to the cervix.

Stage II. The carcinoma extends beyond the cervix but has not reached the pelvic wall. The carcinoma involves the vagina but not the lower third.

Stage III. The carcinoma has reached the pelvic wall. (On rectal examination no "cancer-free" space is found between the tumour and the pelvic wall.) The carcinoma involves the lower third of the vagina.

Stage IV. The carcinoma involves the bladder or the rectum, or both, or has extended beyond the limits previously described.

## CHOICE OF TREATMENT

Opinion among gynecologists has not yet crystallized as to the best method of treating carcinoma of the cervix. This statement, which was made in the first edition of this book, still is equally true at the time of this revision. In general, in the United States and Canada, radical hysterectomy with lymph node dissection was abandoned several years ago in favor of irradiation. After using irradiation for many years in many clinics, much has been accomplished in the successful treatment of the disease. Its shortcomings and complications have also become apparent. Because of these, radical surgery in the form of modifications of the Wertheim operation has been given another trial by Meigs at the Massachusetts General Hospital and by others. Over a period of several years Taussig resected the pelvic lymph nodes, leaving the uterus *in situ* and treating the

cervix with radium. Some clinics have combined the Wertheim type of operation with preoperative or postoperative irradiation. In England, Victor Bonney persisted in using the radical abdominal hysterectomy, in a form slightly modified from that originally described by Wertheim, throughout his long professional life. As will be noted later in this chapter, Bonney's pupils and successors have greatly narrowed their indications for surgery. On the continent of Europe the radical abdominal hysterectomy, irradiation and the radical vaginal extirpation of the uterus and the parametria, as described by Schauta, have all been and still are being practiced in various clinics. The greatest exponent of the radical vaginal approach currently is van Bouwdijk-Bastiaanse of Amsterdam.

Since Martzloff's study in 1923 many attempts have been made to determine the radiosensitivity of cancer cells with the hope of ascertaining which tumors had best be treated by irradiation and which by surgery. Ruth Graham has presented evidence to show that the response of a tumor to irradiation depends principally upon the response of the nonmalignant cells rather than upon the malignant cells themselves. Her evidence was obtained from studying vaginal smears of irradiated cases. Jones, Goldberg, Davis and Burns have pursued this idea further by irradiating the buccal mucosa and studying the effect on the mucosal cells. Their thought is that if radium sensitivity is a general characteristic of the normal cells of the individual, perhaps this could be better detected by studying a relatively clean smear from the buccal mucosa. At the present time it can only be stated that more time will have to elapse before the reliability of these more-or-less theoretical ideas can be proved. It is possible that they may prove to be of great importance in the future.

Finally, since the first edition of this book a school of ultraradical surgeons has appeared, and they are performing more or less complete pelvic exenterations for advanced and recurrent cervical cancer. In this chapter the various methods and results will be considered in some detail. Finally, an attempt will be made to give our own present policy which has evolved from the existing confusion of ideas.



### OPERATIVE RESULTS

In order to obtain a fair opinion regarding the surgical treatment of cervical cancer it is well to view some of the historical milestones. In 1900 when Cullen published his well-known volume, *Cancer of the Uterus*, he reported a 5-year "cure" rate of 26 per cent. This was the rate of cure obtained by operation by the Wertheim technic, or modifications thereof, as practiced at the Johns Hopkins Hospital. The cases operated upon form the basis of his calculations of the percentage of cures. Although many advanced cases were operated upon, many that were seen were rejected. Hence, it is not proper to compare this 26 per cent "cure" rate with the reported "cure" rates of today when the basis of calculation is all cases seen. In 1923 Martzloff reported a 5-year "cure" rate of 26.6 per cent of the cases operated upon and traced. The percentage of "cured," calculated on the basis of the total number of cases operated upon, was 18.6. The operability of Martzloff's cases, on the basis of the extent of the disease, was 46.5 per cent. Martzloff's reported operative mortality for the entire series was 14.2 per cent, but in the later years of his series the operative mortality dropped to between 6 and 7 per cent. This fall in operative mortality probably was attributable to the fact that in later years, only less extensive cases were selected for operation and, in addition, less radical gland dissections were done. In his series, vesicovaginal fistulas complicated the postoperative convalescence in 5.5 per cent of the cases; ureterovaginal fistulas, in 5.2 per cent; and rectovaginal fistulas, in 2.1 per cent.

More recently (1941) Victor Bonney reported 5-year "cures" in 40 per cent of 500 patients upon whom he had performed his modification of the Wertheim operation. His operability rate was 63 per cent, which reduced his percentage of "cures" of all patients seen to 25.2 per cent. In this series, only those cases were irradiated in which masses of carcinoma were known to be left adherent to the great vessels. Bonney, who by long experience had become extremely adept at the Wertheim operation, reported an operative mortality of 14 per cent. This operative mortality is low when two things are taken into consideration: (1) he operated on

many fairly well-advanced cases, since his percentage of operability is relatively high (63%); (2) Bonney's operation in recent years became more radical than the original Wertheim operation, as he removed all glands and cellular tissue that occupy the obturator fossa, as well as the glands lying along the iliac vessels, and also "practically all" of the vagina. Other English surgeons of first rank, though less experienced in this particular operation, report an operative death rate of 21 per cent (Shaw) and 25 per cent (Rivett).

In 1939 Meigs, being dissatisfied with the results with irradiation, began an experiment with an operation which he designated as a "radical abdominal hysterectomy with bilateral pelvic lymph node dissection." Meigs objects to designating his operation as a renaissance of the Wertheim operation. Wertheim did not routinely dissect the pelvic lymph nodes. He did it only after palpation and inspection and occasionally only after opening the retroperitoneal space and inspecting the area. Meigs removes the uterus, the adnexa and a large part of the vagina. With these structures he removes in a block dissection "the parametrium and the pararectal, the paracervical and paravaginal tissues." He removes the common iliac, the external and the internal iliac, the ureteral, the obturator, the presacral nodes and the nodes from the fossae.

Sufficient time has now elapsed so that Meigs is able to report his 5-year results with this radical surgery. There were 344 cases of primary invasive carcinoma of the cervix in his and his colleagues series. The number included 231 Stage I, 109 Stage II and 4 Stage III. In the early years the cases were carefully selected for operability, age and general physical condition. In the later years the indications for surgery were liberalized, since there was no operative mortality in the early group, and no operative deaths occurred when the surgery was undertaken on less favorable cases. One hundred ninety-three patients were followed for 5 years or longer; 139 were in Stage I, 53 in Stage II, and 1 was in Stage III. The 5-year salvage rate in Stage I cases was 75 per cent, and in Stage II cases 54 per cent.

Fistula formation as an operative complication occurred in 45 patients (9% incidence); 35 of these fistulas involved the

ureter. Thirteen (46%) of the 28 ureterovaginal fistulas healed spontaneously between 1 and 10 months. Of these 13 cases, 3 had functional preservation of the involved kidney (1 after repeated ureteral dilatations, 1 after reimplantation of ureter into the bladder, and 1 had no surgical intervention).

Charles Read, who succeeded Bonney, adopted a much more selective attitude toward surgery than did his predecessor. He selected his operative patients from the groups falling into Stages I and II, and they formed only 14 per cent of the total number of patients seen. From these selected cases, 44 per cent were salvaged after 5 years. The operative mortality dropped to 8.3 per cent, and the incidence of fistulas was reduced to 3.1 per cent.

For a consideration of the results in cervical cancer treated by the radical vaginal operation we must go to Europe. This operation was described by Schauta in 1902. It consists of radical extirpation of the uterus and the adnexa, vaginally, together with parametrial tissue, and a wide cuff of the vagina. The procedure is facilitated by the Schuhardt paravaginal incision. The ureters are exposed, and thus injury is avoided as paracervical tissue is removed with the specimen. It is admitted that a gland dissection cannot be made vaginally. The most complete statistics on the results of this procedure are obtained from Peham and Amreich, who report several series of cases from the *I Frauenklinik* in Vienna from 1901 to 1922. Each series is large enough to be of statistical value. The results are as follows:

	NO. OF CASES	PRIMARY OPERATIVE MORTALITY	ABSOLUTE 5-YEAR "CURES"
1901-1906	477	11.4%	15.3%
1906-1911	433	6.4%	19.2%
1911-1916	487	4.3%	21.4%
1916-1920	390	3.5%	21.5%

It is noteworthy that with the passage of years and with improvement in technic, the percentage of cures has decidedly increased, while there has been an even greater improvement in operative mortality. Stoeckel's mortality for the same operation is reported as 4.8 per cent in a series of 258 cases. He reports the incidence of fistulas as follows:

Vesicovaginal	3.5%
Uterovaginal	2.0%
Rectovaginal	1.6%

Van Bouwduijk Bastiaanse of Amsterdam has been the greatest advocate of the Schauta operation in the present generation, and he reports excellent results. His most recently reported over-all 5-year salvage is 59.2 per cent. Stage for stage, his 5-year salvage for cases operated upon in 1953 is as follows:

Stage I	87.5 per cent
Stage II	61.8 per cent
Stage III	15.4 per cent

In spite of these very good results in the hands of an expert, the operation has never attained popularity in the United States. Perhaps the greatest reason is the technical difficulty of the procedure. However, it is being re-evaluated in this country by Milton McCall. Interference with the nerve supply of the bladder often results with temporary and sometimes permanent difficulties of micturition. It is obviously impossible to perform a lymphadenectomy with the Schauta operation, and the greatest argument in its favor in the earlier days was a reduced morbidity and mortality over the radical abdominal operation. In view of the marked reduction in these factors that modern supportive measures now afford, it is questionable as to whether this argument is still valid. However, in the hands of qualified surgeons particularly trained in the special technic of this operation there may be an occasional case in a very obese woman when this operation is the operation of choice. In the opinion of the author this would be a local recurrence following irradiation limited to the cervix in a very obese individual.

#### IRRADIATION RESULTS

Any operative treatment is far from satisfactory in which three fourths or more of the patients ultimately die of carcinoma. This was the situation in the early part of this century. When irradiation was found to have a destructive effect on cancer, carcinoma of the cervix was one of the first lesions to which it was applied extensively. From the standpoint of irradiation therapy, cervical cancer seemed to occupy a strong position. It is essentially a growth on the exterior of the body. Hence, it can be seen readily

through a vaginal speculum in most instances, and it can be treated directly and not through normal tissues as in the case of intraperitoneal carcinoma. The normal mucosa of the vagina and the musculature of the uterus are quite resistant to irradiation and will tolerate strong dosage to the neoplasm without being destroyed. In the beginning, the surgically minded were quite willing to turn over the obviously surgically incurable cases for irradiation but hesitated to relinquish the early cases. It soon became apparent in many of the advanced cases that there was a remarkable destructive effect of the irradiation upon the tumor and, in many instances, a prolongation of life in relative comfort. Gradually, earlier cases were designated for radium and x-ray therapy, and now, after half a century, we can evaluate irradiation therapy and compare the results with those of surgery. In reviewing the results, it is obvious that there has been steady improvement. This is due to 2 factors: (1) earlier cases have been made available to the radiologists for treatment; (2) there has been a gradual improvement in radiologic technic.

The steady improvement is well illustrated in the results of Ward and Sackett, made available by frequent follow-up studies dating from 1925.

YEAR OF FOLLOW-UP	PERCENTAGE OF RELATIVE 5-YEAR "CURES"
1925 .....	23.6
1928 .....	23.1
1930 .....	25.5
1932 .....	24.8
1934 .....	25.28
1937 .....	28.5

Cosbie's figures illustrate the same trend toward improvement in more recent years:

The question is often raised as to how frequently a "5-year cure" is actually a permanent cure. Ward and Sackett's statistics throw light on this question. Of the 359 patients which they were able to follow over a period of 10 years, there was an absolute cure rate of 17.3 per cent and a relative cure rate of 18 per cent. In spite of lowered life expectancy, 73 per cent of those alive at the end of the 5-year period were still alive after 10 years.

Some of the best statistics on the results of irradiation therapy have come from the University of Minnesota. McKelvey *et al.* report the following:

	5-YEAR SALVAGE
Stage I .....	80.2%
Stage II .....	54.1%
Stage III .....	29.5%
Stage IV .....	6%

McKelvey's statistics are on the basis of 299 cases, and there was an absolute 5-year cure rate of 53.6 per cent. These results are considerably better than any others with which we are familiar. Some of this improvement is probably due to the meticulous care in the details of administering therapy and in building up the general condition of the patients, but in scrutinizing the material it is apparent that there is another factor. Of this series 31.6 per cent were classed as Stage I in contrast with 13.7 per cent, occurring in the general statistical report of the League of Nations Health Organization. In addition, McKelvey included in Stage I some cases of carcinoma-in-situ in which the cure rate should approximate 100 per cent. Although McKelvey's results are undoubtedly superior to those of many others, they cannot be fairly compared statistically with previous reports.

Perhaps the best comprehensive picture of

TABLE 4. IMPROVEMENT IN SURVIVAL RATES, 1933-1953

PERIOD	NUMBER	NUMBER	RATE	PER CENT UNTRACED AT
		5-YEAR SURVIVORS		5TH ANNIVERSARY
1933-37	480	154	32.1	2.5
1938-42	1,033	355	34.4	1.8
1943-47	1,303	539	41.4	2.4
1948-52	1,609	725	45.0	4.0
Total*	4,425	1,773	40.1	2.8

\* Carcinoma Stage 0 (carcinoma-in-situ) is excluded from all tables.

what is being accomplished with irradiation therapy can be had from the following summary of results from 37 radiotherapeutic institutions in 11 different countries as reported by Heyman in 1949:

STAGE	RELATIVE APPARENT RECOVERY RATE	PROPORTION OF CASES IN DIFFERENT STAGES
I	61.%	13.7%
II	40.%	35.%
III	22.%	36.%
IV	6.5%	14.%
Total	31.8%	

On the whole, if one compares statistics from year to year over the past decades it would appear that the improvement in the salvage rate in most of the radiotherapeutic institutions throughout the world has been due to a higher percentage of early cases.

#### COMPLICATIONS, MORBIDITY AND MORTALITY OF IRRADIATION THERAPY

Irradiation therapy is not a harmless procedure to be used by the novice. As experience is accumulated it becomes more and more apparent that this two-edged sword should be regarded as a dangerous weapon. It is capable of destroying tumor cells, but it also can destroy normal tissue and even may be responsible for the death of some patients. Malignant cells are more susceptible to the gamma rays of irradiation than normal tissue, and upon this fact the radiologist depends to cure carcinoma of the cervix. Theoretically, all malignant cells can be destroyed by irradiation if the dosage is raised sufficiently high. The difficulty lies in the fact that malignancy must be attacked through normal tissue or in close apposition to it. An attempt to get a maximum of gamma rays into the neoplasm and a minimum into normal tissues is made by directing the x-rays at the tumor target through several portals. The irradiation therapist's problem is to raise the level of his dose to sufficient proportions to destroy the malignancy without overirradiating normal tissues. In attempting this he not infrequently runs into difficulties. His task is further complicated by the fact that the same dosage of irradiation does not produce identical tissue reactions in all patients. Irradiation reactions may be classified as

immediate and late. The immediate reactions have to do with the breaking down of malignant cells and the symptoms resulting from the catabolic products. The immediate reaction may also be due to the lighting up of infection by the irradiation. As a consequence of these reactions the patient may experience "radiation sickness," characterized by anorexia, nausea, vomiting, diarrhea, urgency and frequency of urination, together with a certain amount of prostration. The immediate irradiation reaction is apt to be greater with x-ray than with radium, since a greater volume of tissue is attacked. However, a lighting up of infection as the result of radium application to an infected cervical cancer was not uncommon. Since we have been using antibiotics prophylactically with irradiation therapy, infection is no longer a common complication.

The late effect of irradiation is dependent upon the stimulation of connective tissue growth. Connective tissue may be increased in the bowel, in muscles, in the bladder and in the ureter. Masses of granulation tissue may cause bowel obstruction. Similarly, fibrosis in the bladder wall and the ureters may result in ureteral obstruction and serious kidney damage. Fibrosis is common in the bases of the broad and the uterosacral ligaments. The greatest difficulty may be had in determining how much of this is due to irradiation, how much to infection and how much to an extension of the malignancy. The greatest and most serious late effects of irradiation are dependent upon fibrosis within the walls of the blood vessels. This causes ischemia and resulting necrosis and ulceration. One of the commoner examples of this is central necrosis and sloughing of the cervix. Ulcerations may occur in the bowel wall and eventuate in hemorrhage, perforation, peritonitis and fistula formation. One of the more serious of the lesions due to ischemia is bladder ulceration. This may occur many months and even years after the course of therapy. Lack of blood supply to the femur may result in osteoporosis and fracture.

Morton and Kerner made a study on the complications of irradiation with the idea of determining which technicalities of administration of the rays were responsible for the various complications.

In their series of 621 patients, 6.1 per cent

developed bowel obstruction. Most of the obstructions occurred in the rectosigmoid region, and in about a fourth of them colostomy was necessary. About two thirds occurred in patients who had had 12,000 roentgens in addition to at least 3,000 milligram hours of radium.

Colitis, proctitis or rectal bleeding developed in 12.2 per cent of the treated women. About two thirds of these also occurred in patients who had had 12,000 roentgens in addition to at least 3,000 milligram hours of radium. Aldridge reported intestinal injuries to 31 patients out of 142 treated for carcinoma of the cervix. Among these 31 patients there were 23 with intestinal strictures. In other words, he found that 1 out of every 4 or 5 patients treated for cervical cancer developed an intestinal injury, and approximately 1 out of 6 patients treated had a postirradiation intestinal stricture. In our own clinic the percentage of small bowel injuries was much less. In 226 cases there was only one serious intestinal injury which necessitated bowel resection. For further consideration of bowel injuries due to irradiation see Chapter 46, page 830.

Muscle reaction with myositis and fibrosis occurred in slightly more than 2 per cent of the cases irradiated by Morton and Kerner. Most of them occurred in patients who had had 12,000 roentgens.

Hip fractures occurred in slightly less than 1 per cent in their series, and the majority were in patients in whom the lesion had been treated through lateral as well as the usual anterior and posterior portals.

Fistulas occurred in 2.5 per cent of Morton and Kerner's cases. These were of the vesicovaginal, rectovaginal and enterovaginal type. This figure is somewhat lower than the figure from most clinics. In our own clinic, for example, fistulas of all types totaled 11.4 per cent. Although it is true that excessive dosage may be the cause of fistulas, the incidence of fistulas could not be directly correlated with increased irradiation dosage. Other factors, such as the extension of the growth, play an important role. When due to irradiation, fistulas are dependent upon sloughing brought about by occlusion of vessels by fibrosis. We have seen fistulas make their appearance as long as 12 years after the cessation of therapy.

Radiation necrosis of the cervix is a distressing complication which is undoubtedly due to excessive dosage in some cases but it may occur with only average dosage. The addition of x-radiation by means of a vaginal cone to the average radium dosage to the cervix has been responsible for this in a few of our cases.

A slight increase in bladder irritability for a few days following irradiation is common. More persistent irritability, appearing a few weeks after treatment, is due to edema of the base of the bladder. The symptoms from this usually clear up within a period of weeks. A more serious lesion of the base of the bladder may appear several months or years after treatment. This takes the form of a sloughing ulcer and is due to a slowly progressing endarteritis. Cystoscopically, it can be distinguished with difficulty from an ulcerating, infiltrating cancer. Such lesions usually appear within 2 or 3 years after treatment, but we have seen them occur after 12 years. They are extremely resistant to treatment, and the persistence of acute, distressing symptoms emphasizes the importance of avoiding their occurrence.

Probably the most complete study of the effect of irradiation therapy on the urinary tract has been made by Everett, Brack and Farber. They concluded that of the two components of treatment, variation in the amount of radium administered and more especially the time required to administer it was of more importance than variation in x-ray therapy, provided that excessive x-ray dosage was avoided. They based this conclusion on a comparative study of 2 series of cases. In the earlier series treated at the Kelly Hospital in Baltimore many patients received no x-ray treatment, and several of them had received less than 3,000 mg. hr. of radon. Nevertheless, 15 per cent developed ureteral obstruction of sufficient severity to be of clinical importance, and 20 per cent developed serious bladder lesions. In all of these cases the radon had been administered rapidly and without anesthesia and therefore without the possibility of careful packing of the vagina. The second series of cases were treated at the Johns Hopkins Hospital since 1940. They received 4,800 mg. hr. of radium and from 8,000 to 10,000 roentgens of x-ray. The

TABLE 5. COMPARATIVE RESULTS OF SURGICAL AND RADIATION THERAPY

	STAGE I			STAGE II		
	No. Treated	5-Year Recoveries		No. Treated	5-Year Recoveries	
		No.	Per Cent		No.	Per Cent
Results of treatment at institutions with 40 per cent or more primary hysterectomies in Stage I	1,179	742	62.9	2,047	879	42.9
Results of treatment at institutions with no primary hysterectomies	1,979	1,305	65.9	4,208	1,993	47.4

(Annual Reports—10th Edition)

TABLE 6. COMPARISON OF LONG-TERM RESULTS IN STAGE I CASES

	5-YEAR SURVIVALS		10-YEAR SURVIVALS	
	No.	Per Cent	No.	Per Cent
Radiologically treated only	1,979	65.9	1,325	53.5
Surgically treated in more than 40%	1,179	62.9	828	48.8

(Annual Reports—10th Edition)

radium was administered in two 24-hour applications of 100 mg. with an interval of 2 weeks between treatments. There was no demonstrable urinary-tract damage in the patients who survived 5 years or longer. From these studies they concluded that radium is potentially more dangerous than x-ray therapy in so far as the production of urinary-tract damage is concerned. They also concluded that the danger of damaging the urinary tract is reduced by achieving the desired milligram-hour dosage with smaller amounts of radium administered over longer periods of time.

The average mortality from irradiation has been in the neighborhood of 2 per cent, but Morton has reported 3.7 per cent. In our clinic the mortality rate was 0.4 per cent and has been steadily falling with the use of antibiotics. Death has occurred from prostration closely following the treatment, from pelvic abscess with or without peritonitis, bowel perforation, pyelonephritis with uremia, hemorrhage, bowel obstruction and ileocolic fistula. Septicemia due to the streptococcus is a common terminal condition.

Finally, it can be shown that complications in general increase with increased irradiation dosage, but so does the 5-year salvage. The

problem then appears to be to get the proper dosage to the malignant tumor by the technic which will attain the maximum salvage with the minimum morbidity.

#### OUR CURRENT VIEWS ON TREATMENT

After considering the results of treatment with surgery and irradiation it is probable that the reader is left with a certain amount of confusion as to the best therapy of this disease. After attempting to evaluate the pros and the cons with an unbiased mind we have arrived at certain conclusions regarding the treatment of cervical cancer of Stages I, II, III and IV. Carcinoma-in-situ is considered in a separate chapter, and the treatment of recurrent cancer is considered separately in this chapter.

Rather than attempt to come to a conclusion relative to surgery versus irradiation in Stage I and II by comparing the operative results from one clinic with the irradiation results of another, we had better compare the results published in the annual report from Stockholm. These figures represent a composite picture from the leading clinics of the world (Tables 5 and 6).

From the above two tables one can only conclude that there is no advantage in pri-

mary surgery in the treatment of Stage I and II cervical cancer. The incidence of fistulas resulting from surgery is greater than that of this same group treated by irradiation; most of the fistulas resulting from irradiation occur in the advanced cases in which life expectancy is generally limited. This must be considered a point against surgery.

We believe that, in general, carcinoma of the cervix, Stage I, had best be treated with irradiation as outlined in this chapter. Perhaps one of the greatest sins of surgeons and many gynecologists in the country is to attempt the radical hysterectomy with lymph-gland dissection and slight the completeness of the operation because of technical difficulties. Whenever a surgeon contemplates surgery for cervical cancer he would do well to consult his conscience and ask himself whether or not he is capable of doing the complete and extensive surgery required to equal or better the patient's chance of cure offered her by irradiation.

In our clinic we limit the indications for radical hysterectomy with lymph-gland dissection to those cases of Stage I (and rarely Stage II) in which it becomes obvious that the tumor is not responding to irradiation. This is usually apparent within 6 or 8 weeks.

The only controlled experiment on the treatment of Stage I and Stage II cervical cancer by irradiation and radical surgery was performed by Gray H. Twombly and Howard C. Taylor, Jr., at the Presbyterian Hospital in New York. We quote from their report:

During the years 1945 and 1946 cases of cancer of the cervix, League of Nations Stages I and II, were placed alternately in two groups. The first of these was treated whenever possible by radical surgery and the second by radiation therapy with external roentgen treatment, intravaginal cones and intracavitary radium. Forty-three cases were included in the first group and 44 in the second. At the end of 5 years 58 per cent of the surgical group were alive and well, and 68 per cent of the irradiated group.

This experiment would seem to confirm the opinion expressed above that, in general, Stage I and Stage II cervical cancer is best treated by irradiation.

Concerning Stages III and IV, all gynecologists are agreed that irradiation is the treatment of choice.

### TECHNIC OF IRRADIATION

Numerous different technics of irradiation of cervical carcinoma have been described. In our clinic at the Johns Hopkins Hospital we have varied our technic from time to time, but the one described below is in use at present. It should be emphasized that minor variations from this standard technic are not unusual. Each case should be considered individually, and one should not hesitate to alter the mode of therapy when circumstances require it.

It is important to evaluate the case carefully before treatment is begun. After taking the history, a careful general physical examination is made. An x-ray picture of the chest is a routine procedure. Then the local lesion is inspected through a Graves speculum and is smeared and biopsied. Next, a meticulous vaginal and rectal examination is performed, and an adequate description of the pelvic findings is recorded. In addition, a diagrammatic illustration of the size, the gross appearance and the extent of the lesion is made on a special chart showing lateral, anterior and superior views of the pelvic structure. At the time of this original pelvic evaluation the tumor is classified according to the International Classification. A complete cystoscopic investigation is always done, since this gives valuable information regarding bladder involvement, the extent of parametrial infiltration and the status of the upper urinary tracts. If rectal examination suggests tumor close to the rectum, a proctoscopic study is done.

A combination of radium and external cobalt or deep roentgen therapy is used in all cases where it is feasible. Radium therapy is given first in all clinical Stage I carcinomas, in most of those cases falling into Stage II and in some Stage III carcinomas. The radium therapy is given in at least 2 divided doses. All radium treatments are given in the hospital with the patient under general anesthesia. If there is no contraindication, Pentothal Sodium usually supplemented with Fluothane is our choice. The cervical canal is dilated sufficiently to admit a fountain pen

James F. Didusch

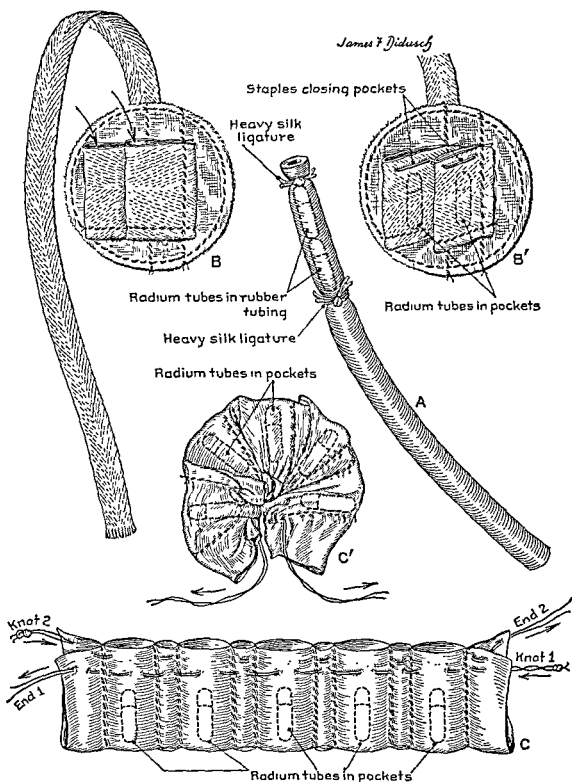


FIG. 222. Paraphernalia for application of radium. (A) Rubber tubing into which radium is tied. (B) Plaque with pockets for radium tubes. (B') Radium tubes held in pockets with staples. (C) Vickers plaque for multiple radium tubes. (C') Drawstrings drawn, converting plaque into rosette.



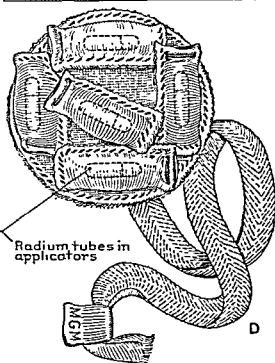
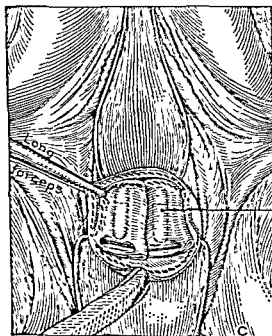
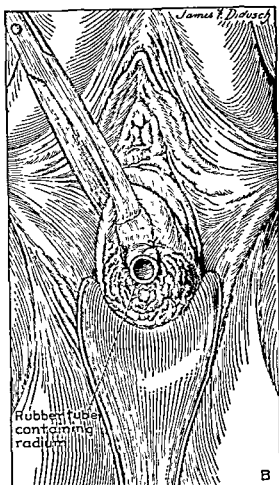


FIG. 223. Method of placing radium. (A) Tube with radium inserted into cervical canal. (B) Tube sutured to cervix and cut flush with cervix. (C) Contracervical plaque in place against cervix. (D) Brack contracervical plaque.

cot or rubber tube containing 2 or 3 radium capsules in tandem (Fig. 222). The strength and the arrangement of the radium capsules are shown in Chart 1. The filtration is 1.5 mm. of platinum equivalent. The pen cot or tube (Fig. 223 A) is sutured to the cervix with a linen suture and is so placed that the lower end of the lower capsule is at the level of the external os (Fig. 223 B). Radium is also applied contracervically. It is enclosed in a linen plaque or in 2 Manchester ovoids. The simplest form of plaque used in treating a small cervix is the so-called "plain plaque"; it contains 2 parallel pockets designed to hold two 25 mg. radium capsules 2 cm. apart (Fig. 222 B). The other type of plaque is the so-called Brack plaque, which has 4 pockets in the form of a square with a single diagonal pocket. It is designed to hold five 10 mg. radium tubes and is used in treating larger lesions (Fig. 223 D). In all plaques the radium tubes are stapled into the pockets with metal staples by means of a stapling machine. Ovoids are the applicators of choice where there is much parametrial involvement. The plaque or ovoids are carefully placed against the cervix, and are packed securely in position, using as many 2-inch gauze packs as are necessary. This is an extremely important step, and it cannot be overemphasized. Not only does the packing serve to hold the applicators in place but also it holds the anterior and the posterior vaginal walls away from the radium, preventing the formation of possible vesicovaginal and rectovaginal fistulas. As Diehl has shown, careful packing pushes the ureters away from the radium, reducing the possibility of radium damage to them.

A mushroom catheter is then inserted into the bladder. This serves to prevent the bladder from filling and encroaching on the radium. The urinary drainage is measured and recorded at 4-hour intervals.

The suggested time of application for the various radium distributions is shown in Chart 1. Location films are taken routinely immediately after the radium application. General anesthesia is not necessary for the removal of the radium, which is usually done under Nembutal-hyoscine-morphine compound sedative.

A similar radium treatment is given in approximately 2 weeks. The technic of

applying the second dose is identical with that of the first application.

Previous to the advent of chemotherapy and antibiotic therapy, acute pelvic infections, usually caused by the streptococcus, but sometimes the result of lighting up of old gonococcal infection, were very common. At present we give 300,000 units of crystalline penicillin G routinely twice a day while the radium is in place, and we continue this treatment until the temperature has been normal for 24 hours. We also require a normal temperature for discharge from the hospital.

When a large cauliflowerlike fungating cervical lesion is present, it is our custom to excise the tumor by means of the electro-surgical unit. This maneuver simplifies the application of radium and gets rid of large quantities of sloughing tumor. Before chemotherapy we never applied radium immediately after excising the cauliflower mass for fear of activating infection, but now the patient is given a rigorous course of chemotherapy and antibiotic therapy, and the radium is applied immediately. We have found this to be entirely safe.

In treating carcinoma of the cervical stump we have found it necessary to vary our technic slightly. In such cases the cervical canal is often too short to accommodate the usual intracervical tandem, and a rubber cot containing a single 25-mg. radium tube usually must suffice. This is supplemented with an appropriate contracervical plaque or ovoids. The same treatment is repeated in 2 weeks.

Upon the completion of the second radium application a composite isodose curve is drawn (to the scale of the patient's pelvis), indicating the number of rads delivered to the pelvis by the radium applications (see Fig. 224 isodose line marked radium). Using this calculation as a guide, Cobalt 60 Teletherapy is started to the parametrial areas 2 weeks following the second radium application. It is designed to supplement the dosage contribution from radium in outlying extensions of the disease beyond the range of radium. These areas may be involved by direct extension of the tumor or by spread to neighboring lymph nodes. The lymph nodes most frequently involved are the obturator nodes on the lateral pelvic wall near where the obturator vessels leave the pelvis,

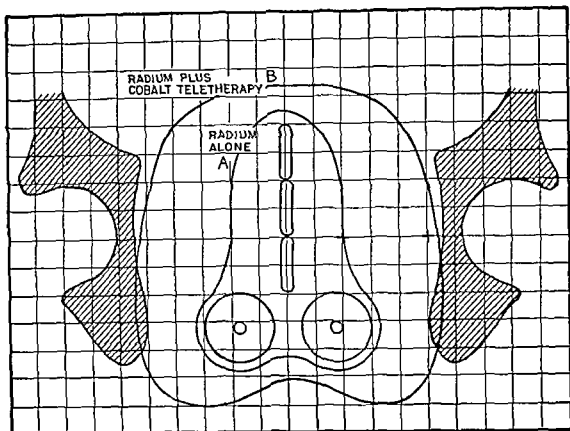


FIG. 224. Isodose curves showing the approximate limits of a dose of 6,000 r given by: (A) Intracavitary radium using medium Manchester ovoids as 3 interuterine sources loaded as shown in Chart 1. (B) Intracavitary radium as above plus the pelvic dose contributed by 4,500 r (mid-plane dose) from Cobalt Teletherapy, with ports as shown in Figure 225.

and the iliac nodes on the posterior wall of the pelvis where the external and the internal iliac vessels originate. External parametrial irradiation must include these nodal groups as well as the tissues lying within the pelvis. Cobalt 60 Teletherapy is used to supplement radium in order to ensure that all structures including the lymph nodes will receive a cancericidal dose of 6,000 rads. The two radium applications contribute a maximum of 1,500 rads to the lateral pelvic walls under ideal conditions (see Chart 1, Point B), and thus a supplementary 4,500 rads with external therapy is required. In order to reduce the time required to set up and treat a patient, two simple opposed fields of 15 cm. wide and 15 cm. long are used, with the mid-line structures shielded by a lead block 4 cm. thick. This block is placed 15 cm. from the skin and is sufficiently wide to give a field

separation of 4 cm. on the skin. This arrangement of fields gives an isodose distribution shown in Figure 225. The central radiation is reduced by the lead shield because the central radium dose (see Point A, Chart 1) is in the region of maximum local tissue tolerance. Roentgenograms are taken with the patient in the treatment position. These port films are reviewed to ensure that the lateral pelvic walls, the iliac and the obturator lymph nodes are within the fields of irradiation. The treated areas should include the inner portion of the acetabula laterally, the entire obturator foramina inferiorly and the lower two thirds of the sacro-iliac joints superiorly.

The over-all treatment time for Cobalt Teletherapy is greater than the radium treatment times because of the large volume of tissue irradiated. Generally, a rate of 1,000

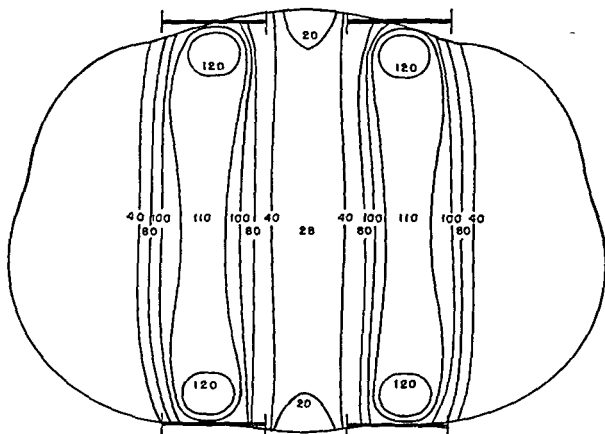


FIG. 225. Composite isodose curves for pelvic Cobalt fields in an average sized patient (AP diameter 21 cm). Four fields, each  $15 \times 5.5$  cm. Setup is with opposing  $15 \times 15$  fields, with a lead block used to give a 4-cm. wide mid-line shielding.

rays to the mid-plane of the pelvis per week is given. Thus 4 to 5 weeks will be required to deliver the supplementary external irradiation of approximately 4,500 rads. This will raise the minimal pelvic and lymph node dose to a uniform 6,000 rads (Fig. 224, isodose line radium and Cobalt).

Special situations require alteration in the external irradiation technics in order to ensure that all potentially neoplastic bearing tissues receive a tumoricidal dose. In carcinoma of the cervical stump limitations are imposed on the insertion of the intracervical tube, resulting in a reduced central radium dose; therefore, the mid-line lead shielding is omitted until a mid-plane dosage of 2,000 rads is reached. Shielding is then added, and the parametrial radiation continued to a mid-plane dose of 4,500 rads from external irradiation.



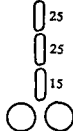


In the extremely obese patient lateral or oblique portals must be added to ensure adequate parametrial and nodal radiation.

**Combined Pelvic Dose.** Dosage to the tissues immediately surrounding the cervix have been obtained by direct physical measurements, utilizing Siemens or Bomke ionization chambers. Other measurements have been calculated from the standard linear source tables of Quimby or Paterson and Parker. These are summarized in Chart 1. In an average-sized patient (AP diameter 20 cm.) utilizing the technics for radium and Telecobalt Therapy as described above, certain critical areas will receive dosages in rads as follows:

TABLE 7. COMBINED PELVIC DOSE

	RADIUM	COBALT	TOTAL
Cervical Canal (C)	12,000	1,100	13,000
Bladder Base (M)	2,500	1,100	3,600
Rectum (M)	2,500	1,100	3,600
Point A	6,000	1,600	7,600
Point B	1,500	4,500	6,000

CHART 1. RADIUM DOSAGE IN CARCINOMA OF THE CERVIX

RADIUM LOADINGS MILLIGRAMS		ROENTGENS PER 24 HOURS TO POINT:*				HOURS FOR 3,000 R TO POINT A
CONTRACERVICAL	INTRA-UTERINE	A	B	C	M	
<i>Ovoids</i>		1,500	450	6-7,000	5-6,000	48
Small: 2 × 20						
		1,900	550	5-6,000	4-6,000	38
Medium: 2 × 25						
		2,500	620	5-6,000	4-6,000	28
Large: 2 × 25						
<i>Plain Plaque</i>						
	1 × 25	1,800	450	17,000	28,000	40
	2 × 25	2,600	600	17,000	29,000	28
2 × 25	3 × 25	2,900	740	17,000	29,000	25
<i>Brack Plaque</i>						
	None	1,000	320	8,000	13,000	72
	1 × 25	1,850	500	12,000	13,500	39
	2 × 25	2,700	650	12,000	14,000	27
5 × 10	3 × 25	3,000	770	12,000	14,000	24
None	2 × 25	1,700	330	4,000	—	43
None	15 + 25 + 25	1,650	400	2,600	—	44

\* Definition of points:

A: 2 cm. lateral to the center of the uterine canal, 2 cm. from end of lowest cervical source.

B: 5 cm. lateral to the center of the uterine canal, 2 cm. from end of lowest cervical source.

C: Cervix—0.5 cm. lateral to center of the uterine canal.

M: Point of maximum dosage on vaginal mucosa.

The doses to the bladder and the rectum are well below the maximum tissue tolerance of these structures, minimizing the annoying irritative cystitis and proctitis and avoiding more serious postradiation complications.

#### TECHNIC: WERTHEIM TYPE OF RADICAL HYSTERECTOMY

When undertaking an operation of this magnitude, time and effort may be spared by giving consideration at the outset to methods of obtaining adequate exposure. The choice of an anesthetic depends somewhat on the anesthesia facilities at a given institution. In our clinic a Pentothal Sodium induction followed by gas, ether and oxygen has proved to be quite satisfactory. Continuous spinal anesthesia, supplemented with a small amount of intravenous Pentothal Sodium, may also give excellent relaxation. It is important that anesthesia be sufficiently deep to prevent loops of bowel from getting into the operative field. The patient is placed in the Trendelenburg position, the degree of tilting of the patient being optional with the operator. Good lighting is essential, and it is important that the light be well adjusted at the outset. An incision from umbilicus to symphysis is usually adequate, but if the patient is obese and if better exposure is obtained by lengthening the incision upward, this should be done. The incision should be carried completely to the symphysis, for the last centimeter at the lower end of the incision is often worth several centimeters at the upper end. Retraction is accomplished with the usual abdominal retractors held by the second assistant. We prefer the movable retractors held by an assistant to more or less stationary self-retaining retractors. The intestines are carefully packed back with moist gauze rolls. A few minutes spent in accomplishing this carefully may save considerable time in the course of the operation.

The operator may stand to the right or the left of the patient according to his preference. Often it is advantageous for him to change sides for the lymph gland dissection, obtaining a better view of the side of the pelvis opposite to the one on which he stands. The fundus is grasped with the Cullen uterine elevator, and the entire pelvis is palpated to

make certain that there is no extension of the carcinoma beyond the uterus. The peritoneum is picked up and cut with scissors at its reflexion onto the anterior surface of the uterus from one round ligament to the other (Fig. 226 A). The bladder is then separated from the cervix and the vagina (Fig. 226 B). This is usually done by blunt finger dissection on either side. In some instances a few snips of the scissors are necessary to cut the more dense mid-line attachment of the bladder to the cervix. The finger is pushed down to about 2 cm. below the tip of the cervix. This may be almost bloodless, but occasionally veins are encountered and torn. If this is the case they should be promptly clamped and tied with fine catgut. At about this stage of the operation it may be well to replace the uterine elevator by an Ochsner clamp at each uterine cornu, clamping the tube, the round ligament and the ovarian ligament en masse. This stops back bleeding from the uterine ends of the round ligaments as they are cut.

The right round ligament is then cut and tied close to the abdominal wall. It is our custom to use No. 0 chromic catgut for ligatures in the course of the operation, but if the catgut is not of first-class quality heavier gut may be used. The anterior leaf of the broad ligament is thus opened. This permits the operator to work his finger around the right infundibulopelvic ligament. At this point it is well for the operator to identify the right ureter as it crosses the pelvis medial to this ligament. The infundibulopelvic ligament is then clamped, cut and doubly ligated. To obtain exposure of the space between and beneath the sheets of the broad ligaments it is often advantageous to leave the ligatures on the round and the infundibulopelvic ligaments long so that gentle traction may be made on them. The fat and the areolar tissue over the right external iliac artery are thus exposed (Fig. 226 C). Starting lateral to the artery, the fat and the areolar tissue are dissected medially, exposing the bare artery and the psoas muscle. As the dissection is carried medially the external iliac vein and the base of the hypogastric artery are laid bare. A lymph node may be encountered in the angle formed by the external iliac and the hypogastric arteries and this must be carefully

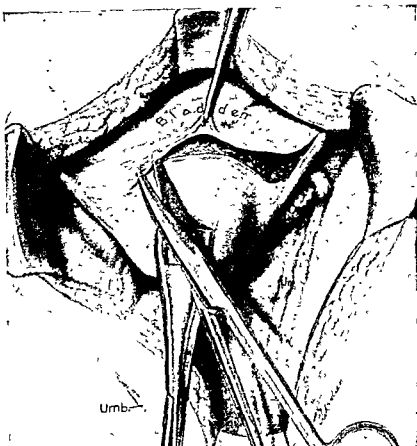
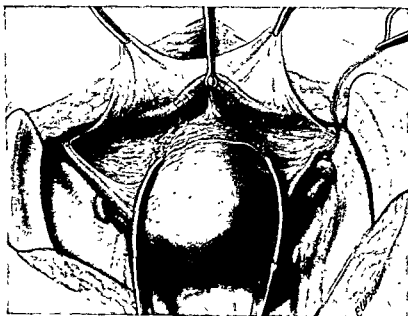


FIG. 226. Wertheim type of radical hysterectomy. (A, *top*) the first step of the operation, the cutting of the peritoneum from round ligament at its reflexion onto the anterior surface of the uterus. (B, *bottom*) The bladder is held up and it is separated chiefly by blunt dissection from the cervix and the vagina. Note the denser attachment in the mid-line which may require cutting with the scissors.



dissected out. The dissection is carried further *en bloc*, removing all iliac nodes below the bifurcation, the hypogastric nodes and the nodes in the obturator fossa. This would seem to be as complete a dissection as is practical. If nodes higher in the abdomen are involved with carcinoma, it would appear that there could be no chance of cure by surgery.

Having cleaned the lymph nodes, the fat and the areolar tissue from the external artery and vein, these vessels are gently retracted laterally, and the obturator fossa is exposed.

The nodes and the areolar tissue are dissected free from this fossa. All of the iliac, the hypogastric and the obturator nodes are reflected toward the uterus, leaving a segment of the ureter, the hypogastric artery, the external iliac vessels and the obturator nerve exposed as shown in Figure 226 D. The dissection is then continued downward, separating the bladder from the anterior leaf of the broad ligament.

Attention is then directed to the further dissection of the right ureter, which always remains adherent to the medial leaf of the

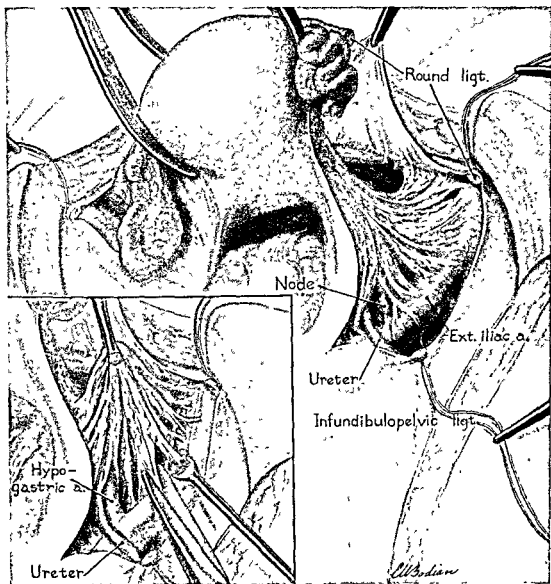


FIG. 226 (Continued). Wertheim type of radical hysterectomy. (C) The right round ligament and the right infundibulopelvic ligaments have been ligated and cut, thus exposing the right external iliac artery. Note the ureter crossing it. Inset shows beginning of dissection of areolar tissue.



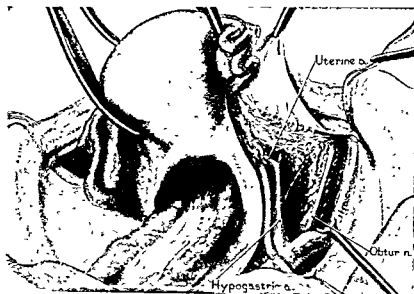
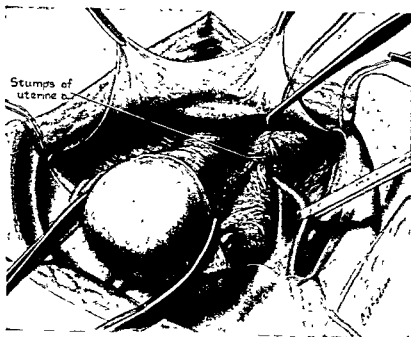


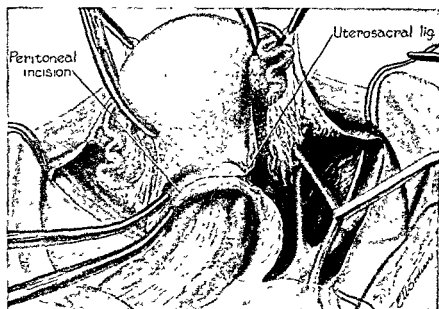
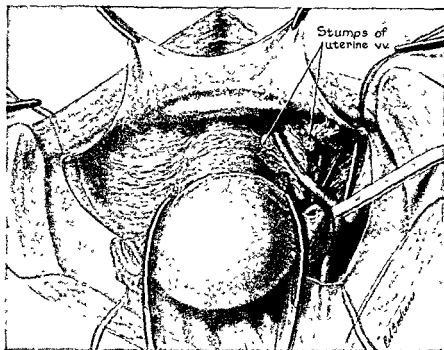
FIG. 226 (*Continued*). Wertheim type of radical hysterectomy. (D, *top*) The nodes and the areolar tissue have been dissected toward the mid-line, exposing the bare iliac vessels and the obturator nerve. Note the uterine artery branching from the hypogastric artery. (E, *bottom*) The uterine artery has been ligated. The plexus of the uterine veins is being ligated, using an aneurysm needle.



broad ligament. At this stage a broad piece of tape is placed about the ureter so that gentle traction may be made on it as necessary from time to time. Although we practice preoperative ureteral catheterization before performing a modified Wertheim operation for carcinoma-in-situ, we do not advocate ureteral catheterization before this operation with pelvic gland dissection. In the operation without lymphadenectomy the ureters are catheterized so that they may be

identified from time to time without freeing them by dissection. In the present operation it is necessary to dissect out the ureters; hence, ureteral catheterization is not necessary. In fact, catheterization may be harmful, as the retraction of the catheterized ureter is more traumatic than retraction of the more flexible uncatheterized ureter. As the ureter is freed downward the uterine branch of the hypogastric artery is encountered crossing over the ureter (Fig. 226 D). The uterine

FIG. 226 (*Continued*). Wertheim type of radical hysterectomy. (F, *top*) The uterine veins have been ligated. The ureter has been freed, even farther than is shown in the picture, until it enters the trigone. (G, *bottom*) The uterus is held upward and forward, exposing the cul-de-sac, which is incised as shown by dotted line.



artery is doubly ligated close to its origin from the hypogastric and cut between the ligatures (Fig. 226 E). In the early days of performing the Wertheim operation Sampson carefully studied and illustrated the blood supply of the ureter. He showed that there was considerable variability in the blood supply of the organ and he emphasized the necessity of being very gentle in handling the ureter and avoidance of stripping it of its vascular sheath. It never should be handled

with a metal instrument; when shifted by the encircling tape, movement should be gentle. Meigs has identified 3 small arteries supplying the pelvic ureter, and he believes that 2 of them may be cut, but if all 3 are cut necrosis and fistula result. The ureter is admittedly one of the stumbling blocks of this operation. If the surgeon slights the dissection he may leave tissue in which cancer cells exist. If he is too meticulous in the dissection of the ureters, necrosis and fistula may ensue. Obvi-

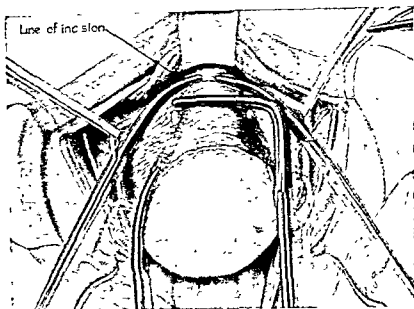
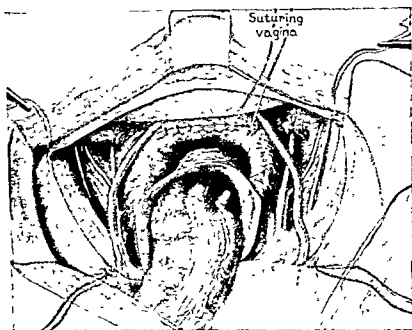


FIG. 226 (*Continued*). Wertheim type of radical hysterectomy. (H, *top*) The dissection is complete. The vagina is doubly clamped, preparatory to cutting across the vagina, after which the entire specimen will be lifted out en masse. (I, *bottom*) The vagina is closed. The pelvis remains to be peritonized.



ously, there must be a compromise. In the upper part of the pelvis the ureter should be left attached to the inner leaf of the broad ligament. It must be freed from its bed as it approaches the uterine artery. The first part of this dissection is relatively easy, but the dissection is more difficult and is attended with more bleeding as it tunnels through connective tissue in the paracervical tissue and continues medially beneath the base of the bladder. The uterine veins form a plexus in

this region and anastomose freely with the veins of the base of the bladder. Bleeding can be very troublesome as the dissection is carried on in this region. These veins can be ligated best by passing an aneurysm needle along the course of the ureter, carrying a ligature through successive masses of this vascular tissue (Fig. 226 E). A clamp may be placed on the uterine side of these veins, or they may also be ligated medially if the clamp proves to be in the way (Fig. 226 F). The

ureter is thus freed from its bed in its lower portion to the point where it enters the trigone. Naturally, the less trauma inflicted on the ureter in this procedure the less apt is one to have necrosis.

After completion of the block dissection of lymph nodes and the areolar tissue on the right and completion of the ureteral dissection as shown in Figure 226 G, the procedure is carried out in a similar manner on the opposite side.

After dissection of both sides of the pelvis the uterus is drawn strongly forward and upward, putting the peritoneum of the cul-de-sac on a stretch. The dotted line shown in Figure 226 G indicates where the peritoneum is to be incised in the cul-de-sac between the uterosacral ligaments. The peritoneal incision gives access to the areolar tissue between the rectum and the vagina. The dissection is continued downward, great care being taken to avoid injury to the anterior rectal wall. Often the rectal wall can be identified by pulling the rectum up sharply. If the peritoneum has been incised at the correct point the dissection can be almost bloodless. If the peritoneal incision is made too high on the rectum, bleeding from the anterior rectal wall may be troublesome.

The more superficial parts of the uterosacral ligaments are clamped, cut and tied when the peritoneum is incised. Having carried this posterior dissection down from 5 to 6 cm. in the mid-line, the deeper continuation of the uterosacral ligaments stands out sharply. They are clamped, cut and ligated as far from the cervix as possible. Care is taken to retract the ureters laterally as these ligaments are cut. An excellent clamp for this deep pelvic work is that of Heaney which was designated originally for vaginal hysterectomy. It is heavy enough to clamp securely rather large masses of tissue; due to the grooving on the jaws, it rarely slips.

Lateral to the uterosacral ligaments are the pararectal spaces filled with areolar tissue. Anterior to these spaces lie the portion of the endopelvic fascia known as the cardinal ligaments of Mackenrodt. Anterior to the cardinal ligaments the tissue is again of areolar character in the paravesical spaces. Mackenrodt's ligaments are strong structures and serve an important function in supporting the cervix and the upper vagina. The

vaginal arteries and veins which come off the hypogastric vessels below the level of the uterine vessels are contained in these structures. These ligaments are clamped and cut as far laterally as possible, the ureters being visualized and thus avoided in this procedure. In this manner the upper portion of the vagina becomes skeletonized and avascular. At least the upper third of the vagina should be removed, and if there is not too great technical difficulty it is better to remove the upper half. The skeletonized vagina is doubly clamped before being cut across (Fig. 226 H). A right-angled Wertheim clamp closes the vagina over the cervix. Heaney clamps are used on the vaginal angles below the Wertheim clamp. If the vagina is not too wide it may be almost completely closed with these clamps. On cutting across the vagina the uterus, the tubes, the ovaries, the parametria, the pelvic lymph glands and the vaginal cuff are lifted out en masse. The vagina is closed transversely with figure-of-eight sutures (Fig. 226 I). Since the uterine ligaments have been severed at some distance from the uterus it is impossible to attach them to the vagina. In spite of this there is no difficulty with prolapse of the shortened vagina. The pelvis is peritonized with a continuous stitch of fine chromic catgut, and no drainage is used, either per vaginam or transabdominally.

## RECURRENT CERVICAL CANCER

### RE-IRRADIATION

Irrespective of the type of treatment, recurrence of the malignant lesion occurs in a disappointing percentage of cases. The question then arises of ultraradical surgery versus further irradiation. But before any course of treatment can be decided upon one must satisfy oneself that there is an actual recurrence. The great problem of recurrence is opportune recognition. This is not an easy problem. Cytology has proved to be of little help. Recurrences are often not in the cervix, and there are so many bizarre cells in the smears that cytologists cannot evaluate them with sufficient accuracy to be of clinical value. Also, biopsy of the cervix or the vaginal vault cannot be depended upon. If the recurrence is superficial, biopsy may confirm the clinical impression; but if it is within the

pelvis, biopsy will be useless. Recurrence in the broad ligament region often is marked by fibrosis, and mistakes are made by confusing fibrosis with carcinoma. Also, recurrences high within the pelvis and even along the aortic chain of lymph glands are out of touch of the examining fingers. Recently, Brack and Burns have made a study of the ultimate fate of patients in whom recurrence was suspected but not susceptible of absolute proof. In 85 per cent of these cases recurrence was eventually proved. Although this statistical study does not give one a clue as to how to be certain of the recurrence, it does suggest that we have often waited too long for an absolute diagnosis before instituting treatment and that perhaps we should proceed more often on the basis of clinical judgment. Cosbie has concluded, with much justification, on reviewing his patients who were re-treated too late or who were not re-treated, that when there is a reasonable possibility of recurrence, an exploratory laparotomy should be done. This alone will allow a thorough examination of the pelvis and the abdomen and often permit biopsy to determine the full extent of the disease. On this basis, re-treatment by radiotherapy in the opinion of Cosbie should be considered as a reasonable alternative to surgery. But there is great difference of opinion regarding the value of re-treatment by irradiation. Some radiologists believe it to be of almost no value. Cosbie believes that by this means "some further control of cancer and prolongation of life can be obtained." In support of this point of view he is able to quote a 5-year survival rate of 15 per cent among patients who had recurrences from under 1 year to over 3 years after the initial treatment.

In contrast with Cosbie's opinion is that of Kottmeier who has had a very extensive experience with irradiation. He states that he is not convinced that recurrences in the pelvic wall can be cured by re-irradiation, and it is used by him only for local recurrences in the lower two thirds of the vagina and for a few selected patients with small recurrences in the parametrium.

#### PELVIC EXENTERATION

Brunswick has attacked the problem of recurrent or radioresistant cervical cancer by

ultraradical surgery in the form of pelvic exenteration. Re-irradiation has not been very effective in our hands, and our experience coincides with that of most gynecologists. The decision then too often lies between certain death and surgical removal. Brunswick enthusiastically supports radical surgery, and there is no doubt that he has saved the lives of some women who were otherwise doomed. In a series of 315 total and anterior exenterations he reports a 12 per cent salvage. Against this salvage one must balance his mortality of 26.6 per cent and the great morbidity which is inevitable in such radical surgery. Brunswick believes that this ultraradical surgery is justifiable for expected palliation of as short a time as a year. We are not in agreement with this point of view, for several months of that year will be spent in recuperation from the operation, only to be followed by slow death from cancer. It is our belief that exenteration should be considered only when after thorough investigation of the patient, locally and generally, it is the considered opinion of the gynecologist that radical surgery offers a reasonable chance of cure. Our disagreement in general with those who have exhibited more enthusiasm for ultraradical surgery is that the cases have been operated upon too often without making as certain as humanly possible that active cancer exists and that it is so localized that surgery offers a reasonable chance of cure.

Of what do these patients die? The majority die of uremia and pyelonephritis, as do the unoperated cases of advanced cervical cancer. Others apparently die with widespread metastases, and sometimes with sepsis. There are many reasons why the salvage from this radical surgery for advanced cervical cancer cannot be expected to effect many cures. (1) Henriksen has shown from studying autopsy material of women dying of cervical cancer that 32.5 per cent of nontreated and 37.8 per cent of the treated cases have distant metastases (Fig. 227). These cases would be lost, regardless of how radical the surgery might be. (2) Henriksen has also shown that the urinary tracts of 82.8 per cent of the nontreated and 78.6 per cent of the treated cases showed hydronephrosis. Implantation of the ureters into the bowel when the upper urinary tract is normal is fraught

with considerable risk and in most instances reduces the patient's longevity. When implanting the ureters of an upper urinary tract already damaged by back pressure, the chances of long survival are not great. (3) The chances of removing all cancer cells after they have extended extensively into the pelvic lymphatics are slight. The location of lymph nodes in close proximity to the great vessels makes it extremely difficult to remove them in toto and leave the walls of the great vessels intact.

After this discouraging review, naturally the question arises, "Is ultraradical surgery ever justified for recurrent cervical cancer?" From what has been stated earlier in this chapter it is obvious that we do not approve

of it as the primary approach to advanced cervical cancer. As for its use in recurrent cervical cancer our present feeling is reflected in a study made by Thompson and Brack on 45 radical surgical procedures for radio-resistant cervical cancer in our clinic. Careful preoperative selection of patients is of utmost importance, as is the preoperative preparation of the patient. Quoting Thompson and Brack:

The extent of pelvic invasion of the tumor is frequently evaluated by an examination under anesthesia with a thorough inspection and biopsy of the cervix and vagina. The bladder and urethra are evaluated by cystoscope and the upper tracts are studied with intravenous pyelography. Renal function is evaluated with the

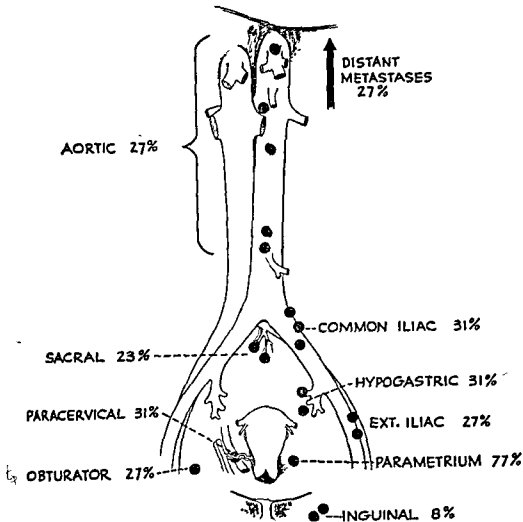


Fig. 227. Node-group involvement in 26 nontreated cases of advanced cervical carcinoma (Henrikson).

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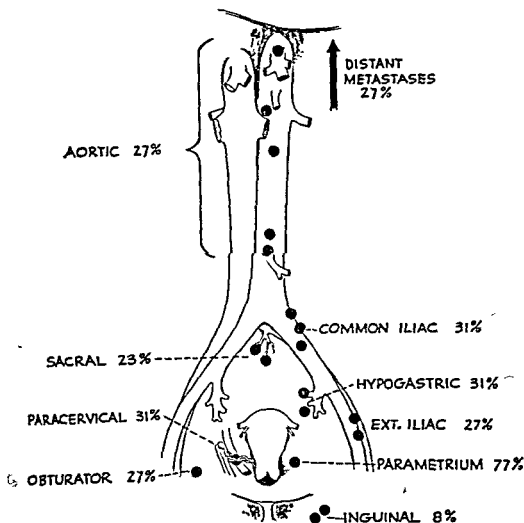


FIG. 227. Node-group involvement in 26 nontreated cases of advanced cervical carcinoma (Henrikson).



phenolsulfonphthalein test and nonprotein nitrogen determination. Barium enema and sigmoidoscopy are done. X-ray examination of the chest, spine, and bony pelvis will help rule out the presence of extrapelvic metastases. The lymph nodes, particularly the inguinal and cervical nodes, are palpated and any suspicious node is removed for study.

If it is felt that the tumor is localized in the pelvis and can be removed surgically, then the patient is prepared for operation. She is seen by a medical consultant, not only to detect and correct abnormalities, but to serve as a baseline for his evaluation of the patient in the post-operative period. The patient may require digitalization before operation. Any anemia is corrected with transfusions, and an attempt is made to keep the patient in positive nitrogen balance.

Every patient has a bowel preparation. Recently neomycin has been used. Twenty-four hours prior to surgery the patient is placed on nothing by mouth (except for the neomycin), and a long intestinal tube is passed. It is not connected to suction until after the operation. On the morning of the operation, enemas are given until the rectum is clear and a small neomycin retention enema is given. In the operating room a tube is placed in the rectum, and a Foley catheter with a 5-cc. inflatable bag is placed in the bladder. A larger bag will interfere with exposure in dissecting between the vagina and bladder. Ureteral catheters are not used since we feel that the catheterized ureter may be more easily damaged when it is handled extensively as is necessary with pelvic lymphadenectomy.

The type of operation done cannot always be determined preoperatively in spite of the above-mentioned examinations. A lower midline incision is made, and the abdomen and the pelvis are explored thoroughly. Biopsies are taken where indicated, and involvement of the rectum or the bladder is determined. If both bladder and rectum are involved, we are not inclined to proceed with a complete exenteration, believing that the chances of cure are too small to justify such a formidable procedure. If either the bladder or the rectum is involved, and exploration of the broad ligaments and the lymph nodes indicates a reasonable chance of cure, we proceed with either anterior or posterior exenteration. If neither the bladder nor the rectum is involved, a radical Wertheim type of operation is done with complete pelvic node dissection.

Twenty-two of the 44 patients were treated by the radical Wertheim type of hysterectomy,

and 22 by means of various exenteration procedures. The total operative mortality was 24.4 per cent, 4.5 per cent for the radical hysterectomies, and 43.5 per cent for the exenteration procedures. The over-all 5-year cure rate of these radioresistant cases, including the exenterations and the Wertheim type of operation, was 25 per cent for a period of from 3 to 5 years. The cure rate of the group on which the Wertheim operation was done was 60 per cent for the same period. In view of these results it is our opinion that radical pelvic surgery done on properly selected recurrent or radioresistant cases is justifiable. However, the performance of pelvic exenteration by the average pelvic surgeon in the ordinary general hospital is not justifiable.

#### CARCINOMA OF THE CERVIX CONCOMITANT WITH PREGNANCY

The co-existence of carcinoma of the cervix and pregnancy is relatively rare. This is necessarily so as the age of maximum incidence of cervical malignancy is much greater than that of pregnancy. Mussey and Maino reported an incidence of 0.7 per cent of coexistence of the two conditions among 3,750 cases of cervical cancer. Danforth reported an incidence of cervical cancer of 0.032 per cent among 10,000 pregnancies. Nevertheless, soon or late, almost every obstetrician or gynecologist is apt to encounter this unfortunate combination. When it does occur it poses a serious problem, as two lives are involved instead of one. Also when cervical cancer occurs during the age period of childbearing there are apt to be small children still very much dependent upon their mother. Hence, the early recognition and proper disposition of the cases becomes of paramount importance.

The question of carcinoma-in-situ is a more or less independent problem during pregnancy, both from the standpoint of the diagnosis and the treatment, and is dealt with under the heading of carcinoma-in-situ. The percentages of the various stages of carcinoma of the cervix during pregnancy closely parallel those of the disease in nonpregnant women. In other words, the same negligence and ignorance which prevent early diagnosis in nonpregnant women also prevail during pregnancy. The symptoms of bleed-

ment for some weeks until the period of viability may be considered. How long one would be justified in deferring treatment requires an individualized answer on each case. The extent of the lesion is important in arriving at the proper answer. For example, in the case of an extremely early lesion one might defer treatment for as much as a month without materially affecting the outcome. Also, with an extremely advanced, almost hopeless lesion, deferring treatment probably will not change the ultimate outlook for the mother, and a healthy child may be salvaged. It is in cases such as these, occurring shortly before the period of viability, that the wishes of the parents may affect the gynecologist's judgment. Not only the desire for the unborn child but also the mother's responsibility to the existing children should be considered. If the decision to sacrifice the child is made, the procedure outlined above for earlier pregnancy should be carried out.

When the carcinoma is detected after the period of viability is reached, no time should be lost in performing classic cesarean section, followed immediately by full irradiation therapy. The Porro section has been advocated by some, but we see no advantage in it over the classic section, and in case the malignancy has advanced up the cervical canal, cancer might be encountered in amputating the corpus.

In general, the 5-year salvage rate for carcinoma of the cervix in pregnancy is almost the same as in the nonpregnant state. At the Mayo Clinic the salvage rate was 33 per cent. Sadugor, Palmer and Reinhard reported 26.9 per cent. It is true that much higher rates of cure have been reported in very small series of cases, but numerically most of these are too small to be significant statistically. Nevertheless, it can be said with certainty that pregnancy per se does not darken the outlook for cure.

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# Carcinoma-in-Situ of the Cervix

There are three fundamental questions regarding carcinoma-in-situ that require answers. When the correct answers to these questions are at hand it is possible that much progress will have been made in the prevention of invasive cervical cancer. These questions are:

1. What is carcinoma-in-situ?
  2. What is the relation between carcinoma-in-situ and invasive cervical cancer?
  3. How should the condition be treated?
- The answers to these questions should be based on sound histologic and clinical evidence and a correlation of the two.

## THE MICROSCOPIC PICTURE

The first question—what is cancer-in-situ? will be answered briefly, and then the microscopic evidence to support this definition will be presented. *Carcinoma-in-situ is a term that should be applied to a microscopic picture of the surface cervical epithelium in which the individual cells through the full thickness*

*of the epithelial layer have the same characteristics as those of invasive cancer.* As a point of departure, the microscopic picture of the normal cervical epithelium should be reviewed. Figure 228 is a typical section. Upon the basement membrane, immediately adjacent to the fibromuscular stroma of the cervix, is a layer of fat spindle cells, the nuclei of which are oval and take a deep hematoxylin stain. The cytoplasm of these cells also stains lightly with hematoxylin. Just superficial to these cells there usually is a layer or two of cells which stain lightly basophilic. As one progresses toward the surface the cells become polyhedral. The nuclei still stain with hematoxylin, but the cytoplasm takes a light eosin stain. Still more superficially the cells become flattened, and although the nuclei stain with hematoxylin the cytoplasm stains rather deeply pink. The most superficial cells are completely flattened and keratinized. In short, there is a gradual transition in form and staining qualities between

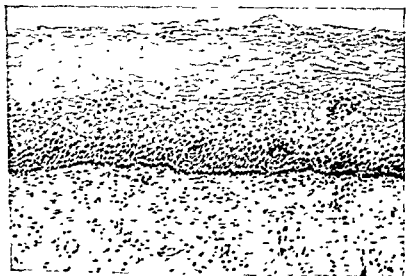


FIG. 228. Normal cervical epithelium. Note the stratification from deepest layer of basal cells to superficial flattened spinal cells.

the perpendicular basal spindle cells and the horizontally flattened superficial cells. In carcinoma-in-situ there is a complete absence of this stratification. The individual cells vary in size and shape, and the nuclei, which are also variable in form, tend to be larger in relation to the cells than those of the normal cells. Many of the nuclei stain heavily with hematoxylin, and mitotic figures are frequent.

This microscopic picture, if seen in the depth of the cervix or in a metastatic position, would mean cancer to the eye of any pathologist. Figures 229 to 231 illustrate typical examples. The transition between carcinoma-in-situ and normal cervical epithelium is often abrupt. The line of demarcation may be perpendicular, as in Figure 232, or oblique, as in Figure 233. On the other hand, the transi-

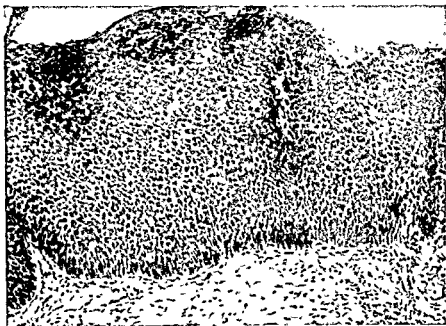


FIG. 229. Carcinoma-in-situ.

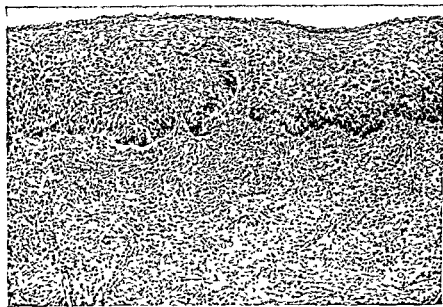


FIG. 230. Carcinoma-in-situ.

tion between the normal epithelial cells and the abnormal may be gradual, but when the entire thickness of the surface epithelium is composed of the cells that are abnormal, the ultimate picture is that of intra-epithelial carcinoma.

There is another microscopic picture in

which the hyperactive cells are limited to the deeper portions of the surface epithelium. We have chosen to call this picture "basal cell hyperactivity." There appears to be all degrees of this abnormal cellular activity. Figure 234, for example, shows only hyperactive-looking cells in the basal layers,

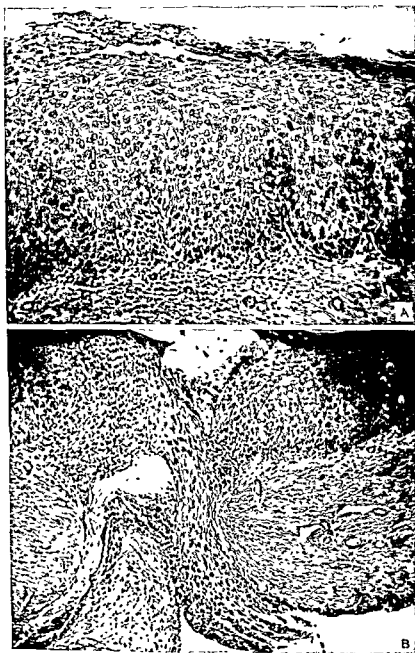


Fig 231. (A) Carcinoma-in-situ. (B) Section from the same case, showing surface cancer growing into lumen of the gland.

whereas the upper layers of cells retain their normal character and stratification. Figure 235 shows a much higher degree of involvement of the epithelium with hyperactive cells, and the transition from abnormal to normal cells is gradual, but the more superficial cells appear to be perfectly benign. Since there are all degrees of involvement of the surface epithelium with hyperactive cells, naturally

there will arise differences of opinion regarding its significance.

Galvin, Jones and the author have attempted to learn the relation between basal cell hyperactivity and carcinoma-in-situ.

To facilitate the study we divided the cases of basal cell hyperactivity into 3 stages, in which Stage I showed only slight divergence from the normal epithelium (Fig. 234);



FIG. 232. Showing definite perpendicular line between intra-epithelial cancer (*left*) and normal epithelium (*right*).

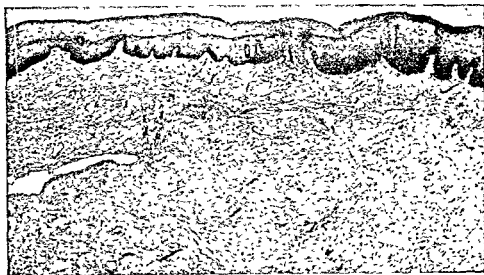


FIG. 233. Oblique line of demarcation between carcinoma-in-situ on the *right* and normal epithelium superficially on the *left*.



FIG. 234. Slight basal cell hyperactivity of cervical epithelium.

Stage II showed more conspicuous changes (Fig. 235) and in Stage III *almost* the entire thickness of the epithelium was taken over by abnormal cells. The study was made on 191 patients, in whom a diagnosis of basal cell hyperactivity was made from biopsy, who

were available for subsequent study. There were 93 patients in Stage I in whom the initial biopsy possessed only a minor degree of basal cell hyperactivity. Further observation with periodic cervical biopsies disclosed that 50 eventually reverted to normal cervical

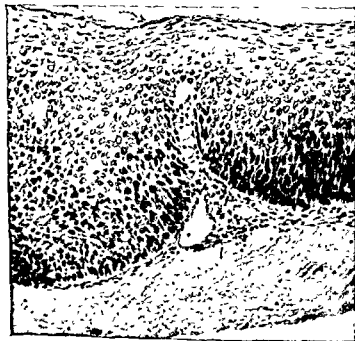
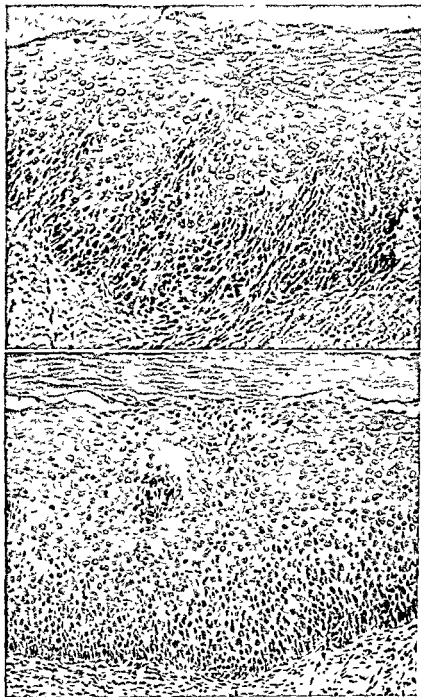


FIG. 235. Marked basal cell hyperactivity of cervical epithelium.



FIG. 236. Progression of basal cell hyperactivity into invasive carcinoma. (A, top) Biopsy taken 1-8-47, showing basal cell hyperactivity but not sufficient activity to justify a diagnosis of carcinoma-in-situ. (B, bottom) Biopsy taken 1-20-47, again showing only basal cell hyperactivity.



epithelium, 28 persisted with some degree of hyperactivity, and 15 showed an apparent progress to a greater degree of hyperactivity. In only 2 (2.1%) did further study show carcinoma-in-situ. Further study of the 63 patients in whom the original biopsy showed a moderate degree of basal cell hyperactivity disclosed that 28 of these regressed, 20 showed no essential change, while 15 apparently progressed, including 8 (11%), in whom the diagnosis of carcinoma-in-situ has

been confirmed. Among the 35 patients initially classified as possessing a marked degree of basal cell hyperactivity, continued observation indicated that 6 had regressed, 6 showed no change, while in 23 (65%) subsequent biopsies satisfied our criteria of carcinoma-in-situ. Figure 236 illustrates such a progression. The cases were followed from 2 to 48 months, and from 3 to 10 biopsies were taken.

From the above study it appears that basal

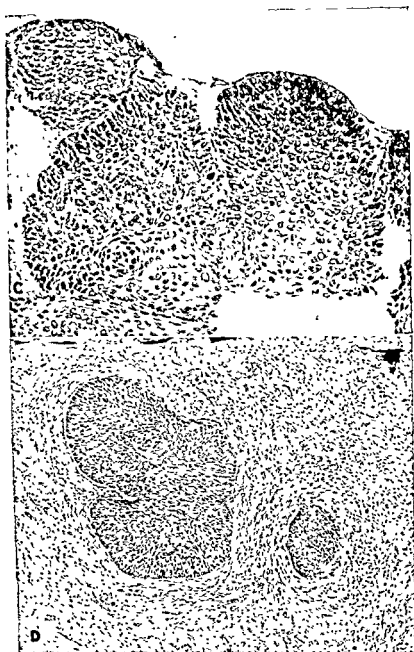


FIG. 236 (*Continued*). Progression of basal cell hyperactivity into invasive carcinoma. (C) Biopsy taken 10-9-47, showing carcinoma-in-situ. (D) Section from tissue obtained by conization on 10-14-47, showing microscopically invasive carcinoma.

cell hyperactivity may regress or progress into true carcinoma-in-situ. The greater the degree of hyperactivity, the greater is the chance of progression into carcinoma-in-situ. The lesser the degree of basal cell hyperactivity the greater is the chance of reversion to normal epithelium. In our study smears were taken simultaneously with the biopsies and in general were in agreement with the biopsy changes.

From a practical point of view the clinician should regard basal cell hyperactivity as a warning, and patients with this condition should be followed carefully for months and even years with smears and biopsies. If subsequent biopsies are still indefinite, a sharp conization of the cervix with cutting of the entire cone into blocks and making many sections of each block usually will confirm or reject the suspicion of malignancy.

FIG. 237. Epidermidization displacing cervical glands well into cervix.



The microscopic description of carcinoma-in-situ would not be complete without calling attention to a lesion which sometimes is confused with it. We refer to epidermidization or squamous cell metaplasia. This condition is found in many chronically infected cervixes and especially in cervical polyps. Replacing the columnar epithelium on the surface and in the depths of the glands is multilayered squamouslike epithelium. Often the cells are vacuolated and otherwise atypical but do not contain the hyperchromatic nuclear changes and mitoses seen in intra-epithelial cancer. Although greatly distorted, some semblance of stratification of the atypical cells remains. The description is best made by photomicrographs, such as Figures 237 and 238. Replacement of all of the columnar epithelium of glands is not uncommon, and the picture may be suggestive of invasion; but careful examination under high-power magnification of the individual cells will show them to be of a benign character. In some instances even epithelial pearls are present (Fig. 239). The final differentiation, as in all malignancy, is made by clinical follow-up of women showing this condition. The author has done this over several years and has found no evidence that these lesions eventuate in malignancy. Uncertain pathologists have

straddled in their decision by calling such lesions precancerous, but there is no evidence that they bear any relation to cancer.

The above descriptions represent our conception of the microscopic picture of carcinoma-in-situ and other conditions related to or confused with it. The histologic conception of intra-epithelial cancer means nothing unless its relation to true cervical cancer can be proved. Hence, we shall attempt to answer our second question regarding the relation of carcinoma-in-situ to invasive cervical cancer.

#### THE RELATION OF CARCINOMA-IN-SITU TO INVASIVE CANCER

The first portrayal of carcinoma-in-situ in the world literature is in Cullen's volume *Cancer of the Uterus*, published in 1900. It is designated as a case of early cervical cancer. On the basis of the cytologic changes Cullen assumed that it was cancer, although there is no invasion of the subjacent tissues. In 1910 Isador Rubin described and pictured 2 cases, microscopically identical with Cullen's, and labeled them "incipient carcinoma." In 1912 Schottländer and Kermauner described the same microscopic picture in the surface epithelium surrounding advanced cervical cancer (Figs. 240 and 241). This has



FIG. 238. Nonmalignant cervical lesion. Although cancerlike in appearance, it is benign epidermidization.



FIG. 239. Epidermidization with pearl formation, found in cervical polyp. This lesion is entirely benign.

been observed repeatedly since then, extending about the periphery of the invasive growth. Schottländer and Kermauner considered this to be a method of extension of the growth. To Schiller belongs the credit for the original thought that cancer of the cervix might begin as a surface lesion, remain on the surface for considerable time before eventually invading the stroma. He presented some clinical evidence to support his views that this surface lesion was actually early cancer. Such evidence consisted of reported deaths with recurrence following total hysterectomy for lesions which were thought to be in-situ.

During the past decade several workers, notably Young, Pund, Blumberg, Galvin and the author, have made histologic studies in an attempt to answer the question regarding the relationship of carcinoma-in-situ to invasive cancer. There is general agreement among these workers that carcinoma-in-situ is often a precursor of the invasive lesion, but there is some disagreement as to the microscopic interpretation of "invasion." Galvin and the author undertook a histologic study on cervixes that had been removed following

a biopsy diagnosis of carcinoma-in-situ. The removed cervixes were cut up completely in blocks, and many sections were made of each block in a search for microscopic invasive cancer. In a total of 108 cases, there were 72 in which atypical cells which appeared to be malignant were found beneath the surface epithelium. Many were within gland lumina (Fig. 242), but in some instances they were definitely within the stroma. Glandular involvement is not true invasion, nor is it equivalent to the filling of the gland with benign cells, as is seen so frequently in epidermidization (Fig. 237). In epidermidization growth stops when the gland lumen is full. In carcinoma-in-situ this is not the case. Figure 243, for example, shows masses of malignant epithelial cells beneath the surface epithelium which is also malignant. In approximately the center of the field is a gland which is filled with malignant cells with destruction of almost all of the columnar epithelium. A bit of columnar epithelium remains, sufficient to show that this plug of cancer cells is "glandular involvement." In this picture, below the gland just referred to, are several large masses of cancer cells. From their shape and arrange-

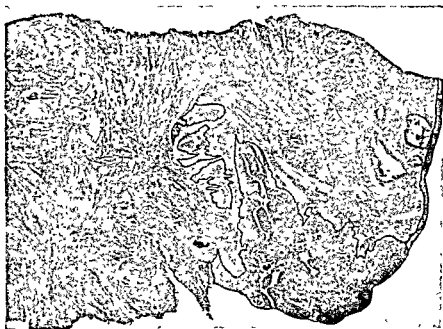


FIG. 240. Low-power section of cervical hp. Intra-epithelial cancer is present on the surface adjacent to the invasive cancer. The cancer is outlined in ink. This is the case shown in microscopic detail in Figure 241.

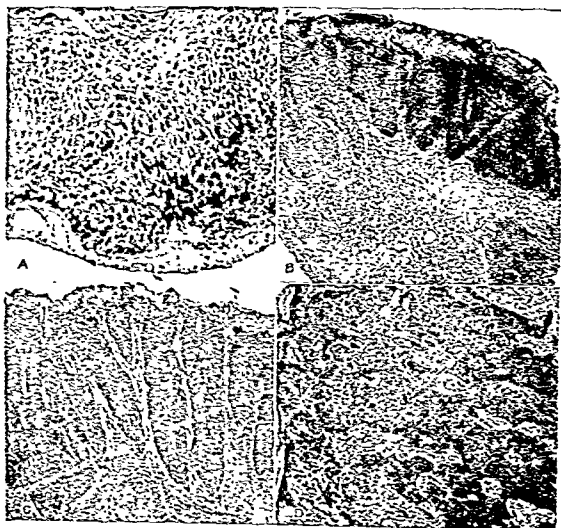


FIG. 242. Destruction of cervical gland by invasion of early carcinoma.

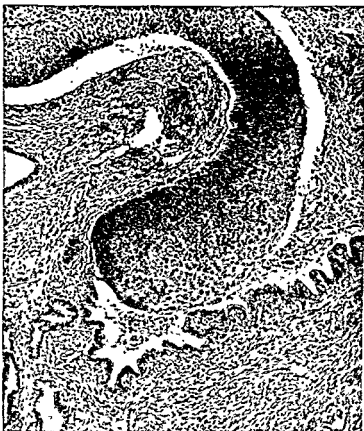


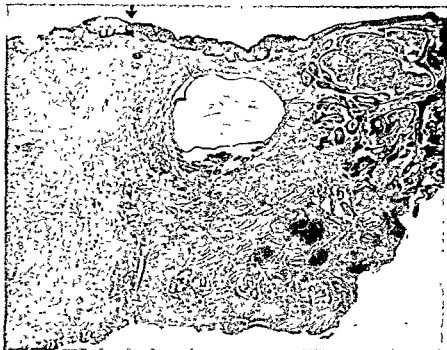
FIG. 243. The upper part of the picture shows the surface carcinoma. Well beneath the surface are "plugs" of carcinoma. In the central part of the picture is one "plug" with a remnant of cervical epithelium remaining. It is probable that the other "plugs" started as glandular involvement and destroyed all trace of pre-existing glandular epithelium.



FIG. 244. (A) Carcinoma-in-situ as found on biopsy. (B) Low-power section, showing glandular involvement and possibly true invasion on the right. (C) High-power section showing surface carcinoma and partial destruction of gland by invasion.



FIG. 245. Low-power section of entire lip of cervix. The dark surface epithelium on the right is carcinoma-in-situ. The bit of epithelium on the left is normal. Deep in the section on the right is extensive glandular involvement and true microscopic invasion. This cervix appeared to be grossly normal.



From the above cited work it is evident that the finding of carcinoma-in-situ in a biopsy many indicate three possibilities as regards the condition of the entire cervix:

1. That the biopsy was taken from the periphery of an advanced cervical cancer, as described by Schottländer and Kermauner.
2. That the carcinoma-in-situ is limited to the surface epithelium.
3. That microscopic glandular involvement or true stromal invasion is present.

It is obvious that in order to know the true status of the cervix one must leave no stone unturned in getting all possible data. Needless to say, the cervix should be carefully inspected and palpated, and all suspicious tissue biopsied for study. This may reveal a truly invasive lesion. If this is not found, the cervix should be conized as described under technic in this chapter. A curettage of the uterine cavity should be done after the cone is taken. The cone should be cut into several blocks, and many sections taken from each block. It is only by meticulous examination of these sections that one can learn the true condition of the cervix. Even with these precautions there will be occasional failures to learn the extent of the lesion. For example, in one instance the lesion which was intra-epithelial on the cervix extended the entire

length of the uterine cavity and became invasive at the fundus. Such a case is, of course, most unusual, but it does illustrate the necessity of complete investigation.

It appears that little, if any, more information regarding the relation of carcinoma-in-situ and invasive cervical cancer can be gained by simple histologic study. Therefore, we must turn to clinical studies to see what evidence can be found. Such studies began with the evidence presented by Schiller when he reported 1 recurrence after 5 years and 2 recurrences before the lapse of 5 years following hysterectomy for this lesion. Galvin and the author reported 1 death following irradiation for what appeared to be carcinoma-in-situ. The death occurred 6 months after treatment, and necropsy showed metastatic cancer. There are at the time of this writing approximately 40 cases in the literature of clinically advanced cancer in which a review in retrospect of previous biopsies showed intra-epithelial cancer. One may object to this type of evidence on the theory that it is coincidental. A recent review of our cases reported by Jones, Galvin and the author would seem to refute this objection. These investigators examined the hospital records of the 723 cases of cervical cancer treated in our therapy clinic for the years

1940 to 1950 inclusive. It was found that 13 of them had had previous cervical biopsies from 1 to 17 years before. Three of these 13 cases were International Stage 0, and the remaining were Stage 1 to 3. The paraffin blocks of the biopsies were still available and were sectioned serially. Of these 13 cases, 11 showed intra-epithelial cancer in the sections thus obtained. In the 12th case there was marked basal cell hyperactivity, and in the 13th case no surface epithelium could be found in the sections. These findings would indicate that invasive cervical cancer is preceded by noninvasive cancer in a high percentage of the cases.

It would seem that there often is a latent period of several years during which the intra-epithelial cancer exists before becoming truly invasive. As evidence of this is the fact that the average age of women with intra-epithelial cancer is about 10 years less than that of women presenting themselves with invasive cancer. In Galvin and the author's series the average age of the women with intra-epithelial cancer was 37.1 years; in Pund's series 36.6 years; and in Younge's series 38 years. The average age of women with clinical cancer is 48 years. The longest reported interim between the biopsy showing carcinoma-in-situ and invasive cancer was 17 years, as reported by Jones, Galvin and the author.

The study of Peterson of Copenhagen throws further light on this question. He kept under observation 127 patients without treatment who had been diagnosed by biopsy as having carcinoma-in-situ. All were followed for at least 3 years; 104 (82%) for at least 5 years; and 38 (30%) for a minimum of 10 years. After 1 year's follow-up 4 per cent of the untreated patients had developed manifest carcinoma of the cervix; at the end of 3 years 11 per cent; at the end of 5 years, 22 per cent; and at the end of 9 years, 33 per cent. At the time of his report 34 of the 127 patients had developed cancer. In 10 the disease was still microscopic; in 17 in Stage I, in 4 in Stage II, in 2 in Stage III and in 1 in Stage IV.

From the evidence presented by Galvin and the author and that of Peterson it is evident that invasive cervical cancer is often preceded by carcinoma-in-situ. This is not

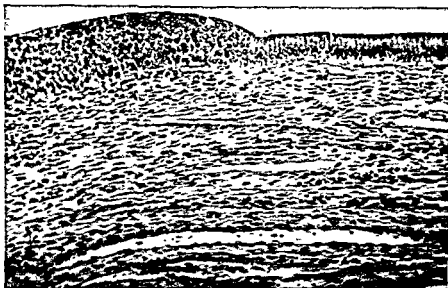
equivalent to saying that carcinoma-in-situ invariably becomes invasive. In fact, it is quite obvious that some women will die of intercurrent disease before the development of the invasive disease. In fact, 8 of Peterson's patients died of other causes within 10 years after the diagnosis of preinvasive cancer had been made.

Naturally, the question arises: Does intra-epithelial carcinoma invariably become invasive? Diddle reported 3 patients where the biopsy diagnosis of intra-epithelial carcinoma was made  $6\frac{1}{3}$ ,  $3\frac{3}{4}$  and  $1\frac{1}{2}$  years prior to total hysterectomy, and multiple sections of the cervix showed only intra-epithelial carcinoma. Jones, Galvin and the author have reported 3 such cases with intervals of 6, 4 and 3 years. Wespi reported 1 such case, there having been a lapse of 8 years. It is obvious that many women die of other diseases before the in-situ lesion becomes invasive.

With the passage of time, since the publication of the second edition of this book, we have accumulated further evidence regarding the relationship of carcinoma-in-situ and invasive cancer in the form of recurrences following hysterectomy. Among 340 cases treated by the modified Wertheim hysterectomy in our clinic since 1944 we have had 7 recurrences. In 3 of these the lesion recurred as an invasive lesion, and in 4 as an in-situ lesion. These recurrences present further evidence of the true malignant nature of this disease.

The above facts may leave the clinical gynecologist somewhat confused as to the course to be taken when a diagnosis of carcinoma-in-situ is made by biopsy or suspected from a positive smear taken from a relatively normal-looking cervix. Today most cases are discovered as the result of a positive or suspicious cervical smear. First, the cervix should be biopsied. We do this rather than proceeding directly with conization, because invasive cervical cancer may be discovered, making conization unnecessary. Conization is a simple surgical procedure, but it is not entirely innocuous with reference to subsequent treatment by hysterectomy or irradiation. One should remember in biopsying the cervix that the pathologist can judge only from the tissue under his microscope.

FIG. 246. Change from columnar epithelium to carcinoma-in-situ at the squamocolumnar junction.



Therefore, a random biopsy means very little from a relatively normal-looking cervix. Several biopsy specimens should be taken around the circumference of the squamocolumnar junction. In addition, 2 or 3 bites should be taken from within the cervical canal. This may be impossible with the nulliparous cervix and in the contracted postmenopausal cervix, and this difficulty is a shortcoming of biopsying versus conization.

If the biopsy specimens show invasive cancer, the case is classified as Stage I and treated with irradiation. If the biopsy shows carcinoma-in-situ or no malignancy, a conization should be done promptly. Sections of the cone will usually reveal the site and the extent of the lesion. If nothing is found, the patient should be followed with further smears. If they remain permanently negative, one may dismiss the thought of malignancy; but if they persist as positive, further cervical tissue should be removed by biopsy and curettage until the lesion is located.

The question arises whether a persistently positive smear ever justifies a hysterectomy in the absence of positive evidence by biopsy or curettage. We have emphasized that histologic evidence should be had before treatment. This is important for two reasons: (1) The smear may be falsely positive. (2) It is important to know as exactly as possible the location and the extent of the lesion. It should be emphasized that a positive smear never constitutes an emergency, and ample time

may be taken for a thorough investigation. However, even after thorough and repeated investigations, nothing may be located, and there comes a point when the nervous system of the patient must be considered. We have on one occasion performed a hysterectomy under such circumstances after a year's observation. In spite of the most meticulous examination of the removed uterus no malignancy was found. Nevertheless, we believe that the hysterectomy was justified in this case, but such cases are extremely rare if all measures are taken to locate the source of the malignant cells seen in the smear.

### TREATMENT

The standard treatment of carcinoma-in-situ in our clinic during the past 15 years has been a rather radical removal of the uterus, including an ample vaginal cuff. In patients over 40 we remove the adnexa, but in younger women we have no hesitancy in saving one or both ovaries. Since the ovaries are points of late metastasis in invasive cervical cancer, it seemed to us very unlikely that there could be involvement of these organs in the preinvasive stage. Our experience bears out this belief, for in none of the cases in which the ovaries were spared has there been recurrence within the ovaries or anywhere within the pelvis. The ureters are catheterized preoperatively so that they can be palpated readily at any time during the operation. This permits the excision of about

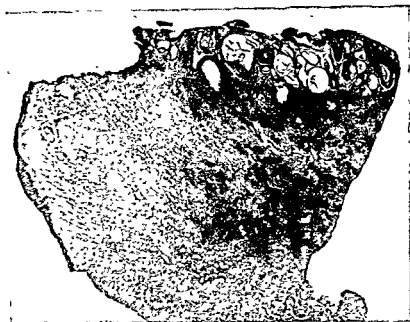


FIG. 247. (A) Low-power section of cervix. Much of surface is covered with carcinoma-in-situ, as shown under high power in B. Well up the cervical canal there is marked glandular involvement, as shown under high power in C.

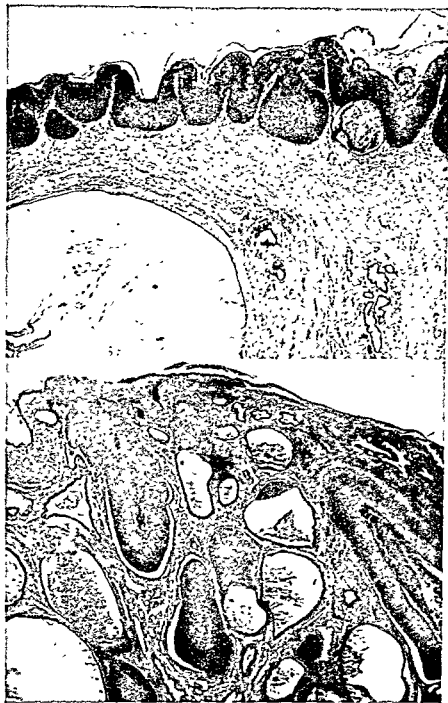
2 cm. of paracervical tissue safely without the necessity of dissecting out the ureters and endangering their blood supply. We have had no ureteral fistulas develop. We believe that the excision of at least 1 cm. of vaginal cuff with the cervix is important, for often the surface lesion is spread over much of the cervix, even when it appears to be normal. Ulfelder has encountered 2 cases in which microscopic examination showed extension of the surface carcinoma onto the cuff, and we have seen 1 such case. In the younger individuals we have not hesitated to save one or both ovaries. All of our 165 cases have remained well, but only 50 of them were operated upon over 5 years ago. Among our cases 8 were treated by irradiation because of contraindications to surgery. All of them have remained well except 1. This patient died within 6 months, and autopsy showed metastatic cancer.

Some of our cases required hysterectomy for other reasons, but all good surgical risks were subjected to hysterectomy in order that the entire uterus might be available for histologic study. The results have been so satisfactory that we are loath to change our method of treatment. Each case is evaluated carefully before surgery is done. If there is a gross lesion, the case is classified as Stage 1 and is treated with irradiation. After the entire cervix has been cut into several blocks

and several sections from each block have been studied the case is evaluated again. If there is more than minimal microscopic invasion the patient is given a full course of x-ray therapy postoperatively. Thus far we have found this to be necessary in only two instances.

It seems apparent from our results that we are treating these patients adequately. The question may be asked justly whether or not we are treating them more radically than is necessary. Ulfelder is in agreement with our plan of treatment and states that, "It would seem hazardous to attempt at present to set up subclassifications of carcinoma-in-situ with the hope of justifying any therapy less than total removal or total destruction." Pund and Blumberg, on the other hand, state, "We do not now believe that it is necessary to remove the uterus in all cases. We do believe an attempt at eradication of the cancer should be made by cauterization in the younger age group. If the patient is 40 years or over, total hysterectomy may be an elective procedure rather than cauterization the cervix." Younger believes that, "The accurate appraisal of the extent of the disease, that is, whether the lesion involves just the surface or is growing into glands and whether it is anaplasia or definite carcinoma-in-situ, determines the type of treatment for each individual case. Conservative treatment, cauterization or con-

FIG. 247 (Continued). (B) Surface carcinoma-in-situ which covered much of the surface of the cervix shown under low power in A. (C) Showing marked glandular involvement well up in the cervical canal. Cervical amputation would have cut directly through this area of carcinoma.



ization, may be performed safely in cases of anaplasia or even definite carcinoma-in-situ if no gland involvement is found on at least 8 punch biopsies 'around the clock' and if tissue from the cervical canal is normal." We agree with Younge in advocating a calm, painstaking and accurate appraisal of each case preoperatively, but, once having diagnosed carcinoma-in-situ, we believe that hysterectomy should be done. Our extensive studies on removed cervixes have shown at

least two things: (1) Glandular involvement is often present as at times is true invasion, when not detected by multiple biopsies. (2) Glandular involvement is present in far too high a percentage of the cases to justify conization or cauterization in those cases which are evaluated preoperatively as strictly surface lesions. We have several uteri which were sectioned after removal that show glandular invasion so high in the cervical canal that amputation might have been done



FIG. 248. Carcinoma-in-situ growing high up in uterine cavity. Note endometrial gland beneath the surface carcinoma. The surface of the cervix, which appeared to be normal, was covered with similar intra-epithelial cancer, but the tumor had become invasive throughout the uterus and has metastasized to the ovaries. This case illustrates the difficulty in judging the extent of the growth from cervical examination.

through the neoplastic tissue or below that level (Fig. 247). We also have encountered several cases in which conization was done, followed by hysterectomy. Complete examination of the uterus showed carcinoma above the level of conization. We have even found carcinoma-in-situ well up in the fundus of the uterus, the cervix of which was covered with carcinoma-in-situ (Fig. 248). Our experience thus brings us into complete agreement with Ulfelder that subclassification of carcinoma-in-situ is hazardous and is not justified preoperatively with the hope of lesser therapy for selected cases. Fourteen of 41 cases treated by Younge with lesser surgery than total hysterectomy required treatment for cervical cancer later. Although some of Younge's conservatively treated women had babies, one wonders whether a justifiable risk was taken. Surely, a golden opportunity to cure a lethal disease was missed.

#### CARCINOMA-IN-SITU IN RELATION TO PREGNANCY

The pregnant woman offers a very favorable opportunity for the detection of incipient cancer while she is under the care of her obstetrician. She should have a routine cervical smear when accepted as a patient. A positive smear or a suspicious one should be followed by cervical biopsies. Also, polyps,

condyomas and friable-looking erosions should be biopsied. Conization in pregnancy may be attended by considerable bleeding and should be avoided, but obtaining specimens by the punch biopsy forceps is quite safe. Epperson *et al.* found that only 1 patient among 286 on whom antepartum cervical biopsies were taken required hospitalization. Since most of the obstetric patients are relatively young, the number of carcinomas picked up will be small. Hirst and Brown found 3 positive smears among 530 pregnant women. All of these women had persistently positive smears from 1 to 31 weeks postpartum, but at the time of the report a definite diagnosis of carcinoma-in-situ had been made in only 1, and the other 2 were still under observation with repeated biopsying.

The literature is very confusing and contradictory concerning the histologic diagnosis of carcinoma-in-situ during pregnancy. The opinion expressed here is based on our own experience. It can be stated that in all cases in which we have made an unequivocal diagnosis of carcinoma-in-situ during the antepartum state, we have been able to confirm the diagnosis after delivery. It is our belief that much of the confusion that exists is due to failure to adhere to the strict criteria mentioned in this chapter.

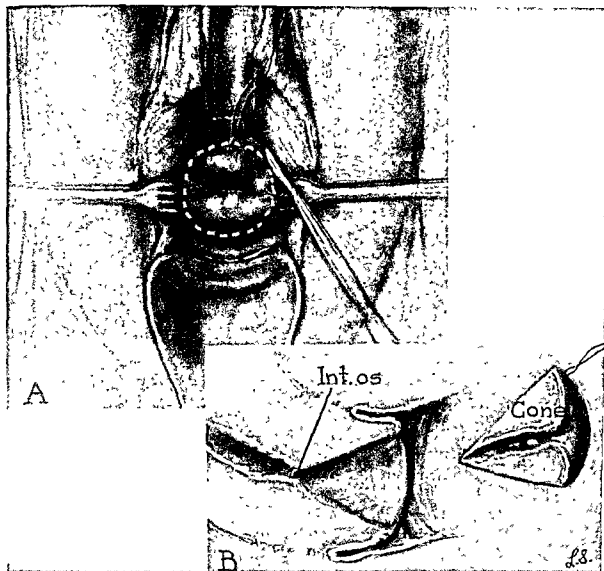


FIG. 249. Technic of conization. (A) The dotted line outlines the circumference, well beyond the area that has failed to take the iodine stain. (B) Shows cervical defect. Cone has been bisected and will be cut further into blocks for microscopic study.

Danforth has made a particular study of the cervical changes during pregnancy. He has stated that, "Since the deviations noted in pregnancy are hyperactive ones, it is suggested that during pregnancy one's attitude toward equivocal or borderline cervical cancers should be particularly conservative." We agree with this but would add that one should exercise such a conservative attitude at all times. Peckham *et al.* have reported on a follow-up study on 19 women of whom the antepartum biopsy was considered by his group of pathologists as carcinoma-in-situ. In 16 (84.2%) the lesions persisted after preg-

nancy. They maintain that such lesions cannot be dismissed as evanescent "pregnancy changes," nor do they maintain that the 3 lesions which they failed to find after pregnancy were removed by biopsy, although this is a possibility. They do not believe that their inability to find these lesions subsequently can be attributed to a self-limited specific pregnancy change. It is not uncommon to fail to find a lesion in subsequent biopsies, and even in the cervix after hysterectomy in non-pregnant women.

Even though there is some difference of opinion among pathologists concerning the

diagnosis in pregnant women, the problem is not too difficult from a practical clinical point of view. Except in very rare instances we do not believe it necessary to hysterectomize pregnant women in whom a diagnosis of carcinoma-in-situ has been made. They may be permitted to complete their pregnancy, and several weeks later they may be conized and treated on exactly the same basis as other patients.

#### TECHNIC: CONIZATION

The cervix is first painted with Lugol's solution. An incision is made beyond the area which fails to stain as shown in Figure 249 A. Using a small-bladed knife, the circular incision is directed toward the internal os, free-

ing the cone as shown in Figure 249 B. The cone is fixed immediately in Vandergrift's solution. If bleeding is free, sutures may be placed laterally on the cervix. If there is only a little oozing, it may be controlled by sparking with the high-frequency current. Occasionally, both ligating and fulguration are necessary, and sometimes bleeding is so slight that only a sponge may be placed against the cut surface.

#### TECHNIC: RADICAL HYSTERECTOMY WITHOUT LYMPH NODE DISSECTION FOR CARCINOMA-IN-SITU

Before being anesthetized, the patient is placed in the knee-chest posture and is cyto-



FIG. 250. Radical hysterectomy for carcinoma-in-situ. (A) Round ligaments and infundibulopelvic ligaments have been cut and ligated as in the usual hysterectomy. The broad ligament has been opened widely, exposing the ureter which has been catheterized. The right uterine vessels have been ligated lateral to the catheter.



scoped by the Kelly air method. Both ureters are catheterized with No. 7 catheters, the cystoscope is removed, and the bladder is emptied of air by a catheter. Before the laparotomy the vagina and the cervix should be painted or sprayed with iodine solution. The Schiller test is not absolutely specific but is sometimes useful in determining the extent of the surface involved by the lesion. Among our own series of 340 cases of carcinoma-in-situ we have had 7 recurrences in the vaginal vault. It is probable that some of these could have been avoided if a Schiller test had been done routinely before the hys-

terectomy and more vagina removed when indicated.

The patient is then placed on the operating table and anesthetized. The vagina is cleaned up with soap, water and alcohol. Then it is swabbed out with Scott's solution, and a dry sterile sponge is placed in the vagina to absorb secretions that may be massaged from the uterus on manipulation at operation. This sponge is removed just before the vagina is opened. The abdomen is prepared according to routine and draped for an infra-umbilical mid-line incision, and the table is put in a marked Trendelenburg position.

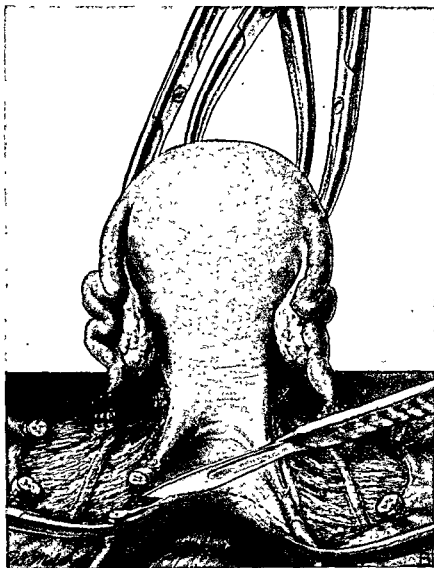


FIG. 250. (*Continued*). Radical hysterectomy for carcinoma-in-situ. (B) Uterosacral ligaments have been clamped and ligated and are being cut. The peritoneum between the two ligaments is cut as indicated by the dotted line.

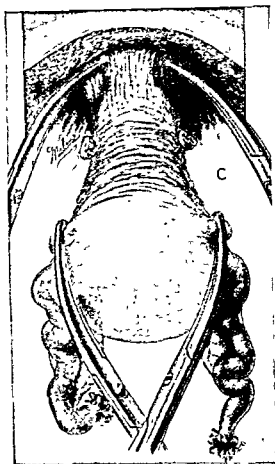


FIG. 250 (Continued). Radical hysterectomy for carcinoma-in-situ. (C) The bladder has been dissected down from the pubocervical fascia, well below the tip of the cervix. The pubocervical fascia and the vaginal wall are grasped on both sides with curved Ochsner clamps.

A mid-line incision is made, extending from umbilicus to symphysis. If it is necessary for proper exposure of the pelvic organs to carry the incision above the umbilicus, it should be done, but such procedure is seldom required. The intestines are packed back with moist gauze packs. It is well to spend a little time and do this quite thoroughly in order not to be annoyed during the course of the operation by loops of intestine getting into the operative field. The pelvis is explored manually to make certain that there has been no extension of the growth beyond the uterus. Since one is dealing with microscopic cancer

of the cervix, such an extension is very unlikely, but it is well to carry out this precaution on the rare chance that the cervical lesion was misjudged.

The round ligament on one side is clamped, cut and ligated at least 1 cm. from the uterine cornu. The infundibulopelvic ligament is then clamped, cut and doubly ligated well out toward the pelvic wall. In doing this one should be certain that the ureter is not included in the suture ligature—a likelihood that is not great although it can occur. The ureters that have been catheterized are easily palpable, and there is no difficulty in avoiding them.

This procedure is repeated on the opposite side, or, if the adnexa are to be conserved on one side, the clamps and the ligatures are placed accordingly.

The bladder peritoneum is cut at its reflexion onto the anterior surface of the uterus, as in the ordinary hysterectomy. This cut is made so as to join the openings in the anterior leaves of the broad ligaments resulting from cutting the round ligaments. The bladder is then dissected down from its attachment to the cervix. To prevent unnecessary bleeding, the freeing of the bladder from the vagina to the point ultimately required should not be done at this stage. Up to this point the operation does not differ from an ordinary hysterectomy.

The peritoneum forming the posterior leaf of each broad ligament is then cut downward parallel with the side of the uterus, and the structures in the bases of the broad ligaments are exposed. The catheterized ureters should then be easily palpable and located to permit double ligation of the uterine vessels as far laterally as possible (Fig. 250 A). The uterine end of the vessels should also be ligated to free the operative field of clamps. This procedure of ligation of the uterine vessels can be carried out without freeing the ureters from their beds, and thus any injury to their blood supply is avoided.

After the uterine vessels have been ligated bilaterally in this way another bite of parametrial tissue is made with Ochsner clamps on both sides 1 or 2 cm. from the side of the cervix, care again being taken to avoid the ureters. This clamped tissue which constitutes

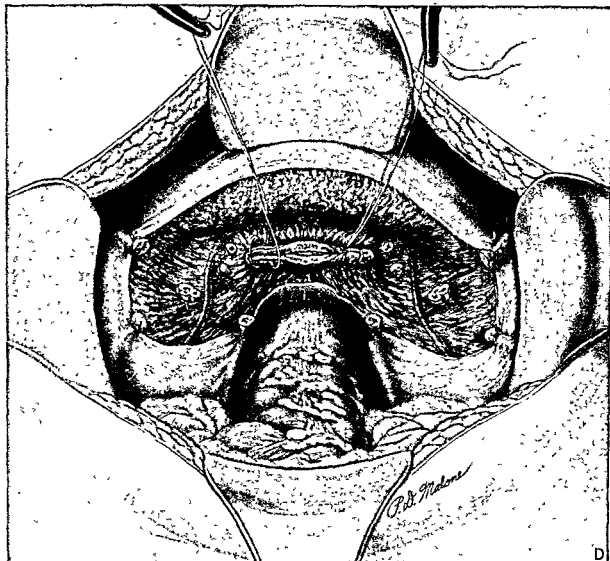


FIG. 250 (Continued). Radical hysterectomy for carcinoma-in-situ. (D) The uterus has been removed, and the vagina is being closed with figure-of-eight sutures of chromic catgut. Note the ligated uterine vessels and the ligatures about the vessels of paracervical and paravaginal tissues.

the bases of the broad ligaments is then cut and ligated. This tissue is ligated by a suture placed just beyond the tip of the clamp and tied as the clamp is slowly released. In some instances it is necessary to take a second bite of tissue parallel and lateral with the first.

Next, the uterosacral ligaments are clamped at a point at least 1 cm. from the cervix. They are ligated on the uterine side and cut between the clamps and the ligatures, as shown in Figure 250 B.

The bladder is now dissected farther down, freeing it from the pubovesicocervical fascia

which covers the vagina. This fascia is easily recognized by its longitudinal fibers. The lateral paravaginal tissue is next clamped, cut and ligated on either side of the vagina, taking successive bites with Ochsner clamps until a point is reached where the vagina can be cut across well below the cervix. In carrying this lateral clamping, cutting and ligating down to this point it is necessary from time to time to dissect the bladder down still farther to avoid catching it in the clamps. Sometimes bleeding is encountered from both the bladder and the fascia in making this dissection. It is well to clamp and ligate these ves-

sels as they are encountered in order to keep the field as dry as possible.

When the vagina has been freed sufficiently far down to permit amputation with a good cuff of vagina on the cervix, the lateral portions of the vagina, covered with the pubovesicocervical fascia, are clamped for a short distance with Ochsner clamps (Fig. 250 C). As the vagina is cut across, an assistant grasps the anterior and the posterior vaginal walls with straight Ochsner clamps as necessary to control bleeding.

The vagina is closed with figure-of-eight sutures of chromic catgut (Fig. 250 D). The vagina is suspended by bringing in the round and the uterosacral ligaments and suturing them to the cut edge of the vagina. Because the uterine vessels have been ligated so far laterally in this operation, no attempt is made to bring in these vessels with the basal broad ligament tissue attached to them, as is done in the conservative hysterectomy.

The pelvis is peritonized by suturing the bladder peritoneum to the posterior surface of the vagina and closing the broad ligaments

by suturing the anterior and the posterior leaves together with a continuous suture of No. 0 plain catgut. The infundibulopelvic stumps are inverted beneath folds of peritoneum (Fig. 250 E).

#### THE TREATMENT OF RECURRENCES

Several recurrences in the vaginal vault have been reported in the literature. We have had 8 such recurrences among our 340 cases of in-situ carcinoma. The recurrence in 3 instances were as invasive cancer; in the others the recurrent lesion was still in situ. As stated previously, some of these might have been avoided if a Schiller test had been done on all cases preoperatively to ascertain the extent of the lesion in the upper vagina. If the recurrence is in the form of invasive cancer it should be treated as indicated in Chapter 22. If the recurrent lesion is still in situ, the lesion may be treated by vaginectomy or by irradiation. We have used both methods, and all of the 8 recurrent cases are well to date. Our personal preference is for

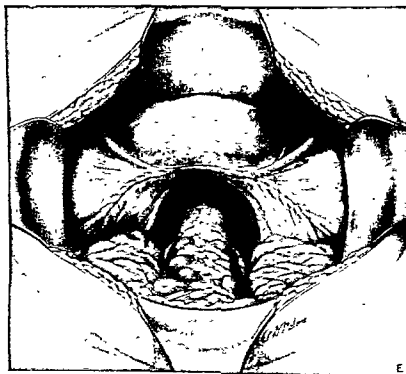


FIG. 250 (Continued). (E) Pelvis is completely peritonized after vagina is closed without drainage.

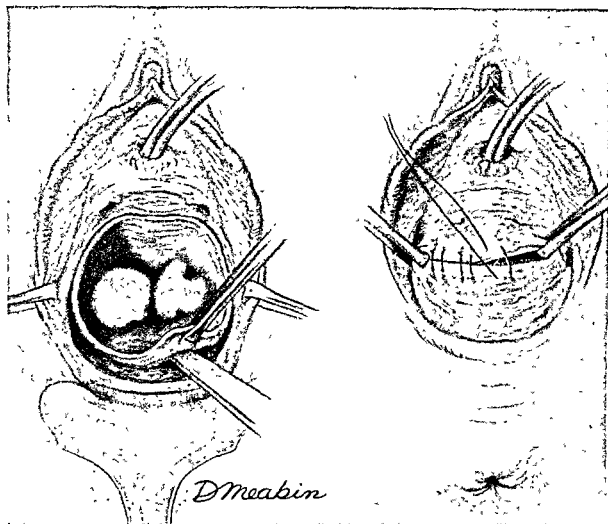


FIG. 251. Recurrent carcinoma-in-situ shown by Schiller's test. In order to be certain of complete removal, the vagina is circumcised and dissected free as far as feasible before completing the vaginectomy abdominally.

vaginectomy, but if the patient strongly desires a functioning vagina we have used irradiation. We cannot honestly state that the use of a radium plaque is not as satisfactory as surgery. At least our recurrences so treated have remained well. If the recurrence is suffi-

ciently extensive to require complete vaginectomy, it had best be started from below, as shown in Figure 251. For the technic of complete vaginectomy the reader is referred to the chapter concerned with primary carcinoma of the vagina.

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# Carcinoma of the Corpus Uteri

## GENERAL CONSIDERATIONS

Carcinoma of the corpus uteri occurs much less frequently than carcinoma of the cervix, the ratio in our clinic being 1 to 4.7. At the *Woman's Hospital of New York* the ratio is 1 to 5; at *Jefferson Medical College*, 1 to 9.58; at the *Howard A. Kelly Hospital*, 1 to 14; at the *Memorial Hospital of New York*, 1 to 4; and *Sampson* has reported an incidence of 1 to 2. While there is no certain explanation for this wide variation in the relative incidence of these diseases, the percentage of Hebrew population in different communities may be a factor. The Hebrews, who have a marked racial immunity to carcinoma of the cervix, do not have immunity to corpus carcinoma, and this fact may account for the relatively high percentage of carcinoma of the corpus in New York hospitals.

*Corpus carcinoma* is a disease that occurs most frequently during and after the menopausal years. *Marshall* found the average age among 214 women suffering from this disease to be 59.9 years; in *Henriksen's* series it was 56.4 years. *Scheffey* and *Thudium* reported that 80.9 per cent were between the ages of 50 and 60; the average age was in the neighborhood of 58 years. They also found that 21.3 per cent were still menstruating, and 78.7 per cent of the women were from 1 to 26 years postmenopausal. Although the disease is encountered occasionally in the 5th decade, it rarely appears before that time. We have seen one case in a colored girl of 22 years, but such curious occurrences are rare.

Considerable interest has been focused recently upon the relation of the occurrence of endometrial malignancy to the age of the menopause. *Corscaden*, *Gusberg* and *Randall* have suggested that prolonged, unopposed

estrogenic stimulation of the endometrium might eventually be a factor in the development of malignancy. *Randall* found that 35 per cent of women with adenocarcinoma of the endometrium had continued to menstruate beyond the age of 50. That percentage does not appear to the author to be of great significance, for it would seem to differ little from that of the general population. *Henriksen* and *Murrieta* found the average age of the menopause in their postmenopausal women with this disease to have been 46.3 years, and in *Marshall's* series it was 48.7 years. These figures coincide with the normal menopausal age and would indicate to us that there probably is no significant relation of the age of menopausal occurrence to the incidence of endometrial cancer. However, it is only fair to say that several cases have appeared in the literature recently in which endometrial carcinoma was diagnosed after prolonged artificial endometrial stimulation by estrogens. Whether this is coincidental or causal cannot be answered at this time.

In recent years there have appeared in the literature several articles based on the histologic study of the ovaries of patients with endometrial carcinoma, indicating a significant increase in the occurrence of ovarian stromal hyperplasia. This finding suggested that unopposed prolonged estrogen stimulation might be a factor in the etiology of endometrial cancer. The literature is conflicting, but one of the best-controlled reports is that of *Roddick* and *Greene*, who studied the ovaries of 40 women with endometrial cancer and of 42 women without this disease. Their study failed to find a difference between the ovaries of those with and those without endometrial cancer. After reviewing the literature on the subject, we are inclined

to believe that Roddick and Greene's work is the most convincing.

It does appear that obesity and carcinoma of the corpus are frequently coincidental in the same patient. Marshall found that about half of his cases were described as obese, and 17 per cent of the women were excessively obese. Diabetes also seems to be relatively common, although all investigators are not in accord on this question. Scheffey found it in 11 per cent of his cases, Stanley Way in 29 per cent, and Palmer in 16 per cent. On the other hand, Vander, in a study of 483 women with endometrial cancer, found diabetes mellitus in only 5.6 per cent compared with 5.4 per cent in the general population of the same sex and age. Vander suggests that possibly different criteria for the diagnosis of diabetes may be a factor in the discrepancies.

Some authors have attempted to show that sterility and nulliparity are factors in the etiology of this disease. The figures presented to prove this are not very convincing, and we do not believe that they are statistically significant.

Since the disease occurs chiefly after the menopause, the usual symptom is postmenopausal bleeding; often this is not profuse and is described by the patient as spotting. In most cases that occur before the menopause, intermenstrual bleeding is the initial symptom. The complaint may refer to a thin, watery discharge, but on investigation such discharge usually contains some blood. Next to carcinoma of the cervix, corpus carcinoma is the commonest cause of postmenopausal bleeding. If the patient bleeds after the menopause and yet has a cervix that appears to be normal on inspection, the chances are strongly in favor of endometrial carcinoma. In reviewing our cases of bleeding after the menopause we found corpus carcinoma to be responsible for the appearance of blood in approximately 15 per cent. However, it must be stated that this figure was arrived at before the days when estrogen therapy became as prevalent as it is today. The percentage would undoubtedly be lower today, but endometrial cancer still ranks high as a cause of postmenopausal bleeding. The symptoms of advanced corpus carcinoma are similar to those

of advanced carcinoma in general. Special interest is attached to the symptom of pain from a prognostic viewpoint as it usually, although not always, signifies extension of the disease beyond the uterus. Occlusion of the cervix with pyometra formation may give rise to pain when the disease is still limited to the uterus. At any rate, regardless of the cause of pain, Healy and Brown found that 66 per cent of the patients complaining of pain eventually died of cancer, and in nearly half of these cases the initial examination revealed no evidence of the extension of carcinoma beyond the uterus.

### DIAGNOSIS

In the majority of cases of corpus carcinoma there is no enlargement of the uterus resulting from carcinoma. Incidental fibroids are common, but the frequent presence of these common tumors with endometrial cancer by no means indicates a common etiologic factor. The general incidence of fibroids is too great to support such an opinion. When fibroids are found after the menopause one never should accept them as the cause of bleeding without first performing a curettage to exclude endometrial cancer. When corpus cancer has existed for a considerable period of time, the uterus may become palpably enlarged, due to extension of the malignant growth into the myometrium and even onto the serous surface. Extension into the adnexal regions may make difficult the differentiation between primary endometrial cancer with extension to the adnexa and primary ovarian neoplasm. Occasionally, a fungating friable mass protrudes from the cervix. Friable particles may come away on the examining glove or may be removed with a biopsy clamp which on section prove to be endometrial cancer. Extension to the upper vagina occurs at times, and this tissue, too, may be easily biopsied.

Cytologic examination of vaginal smears is of less value in detecting endometrial cancer than that arising from the cervix due to frequent occlusion of the cervical canal in elderly women, and of course the final diagnosis should not be made without confirmation of the positive or suspicious smear by curettage. However, frequently vaginal smear



has given rise to the suspicion which ultimately led to the diagnosis of corpus carcinoma. There is the possibility of picking up an occasional, asymptomatic case by smear. Henriksen and Murrieta found that 6.5 per cent of their cases had presented no noticeable symptoms. It is probable that some of these could have been detected by a routine screening smear.

In considering diagnosis it is important to bear in mind the possibility of corpus carcinoma in every woman over 40 with intermenstrual or postmenopausal bleeding. It should be kept in mind even *when this bleeding is slight and when it appears for the first time*. Often women are inclined to disregard this sign, and all too frequently the busy family doctor and even the gynecologist defer investigation because the show of blood has been slight. Corpus carcinoma should be kept in mind, even though there is another obvious lesion present, such as postmenopausal vaginitis, cervical polyp or fibroids. The way one can be most certain of the presence or the absence of endometrial cancer is by curettage. Usually, a large amount of friable material is obtained at the first stroke of the curette, but there is danger in jumping to the conclusion that this is carcinomatous tissue. Endometrial hyperplasia sometimes gives rise to abundant tissue that may be grossly indistinguishable from endometrial cancer. On the other hand, we have found by microscopic examination endometrial cancer to be present when no grossly visible endometrium could be made out in the blood obtained at curettage.

Curtis believes that "curettage should not be undertaken lightly." He fears spilling of carcinomatous tissue, perforation of the necrotic uterus and dissemination of infection in the presence of pyometra. In the typical case with postmenopausal bleeding well beyond the menopause with a freely movable uterus slightly enlarged, he favors immediate hysterectomy with bilateral salpingo-oophorectomy. Such a policy is bound to result in unnecessary major surgery in elderly women. We have seen innumerable "typical" cases in which curettage has failed to reveal carcinoma. In fact, if one investigates in any gynecologic pathology laboratory one will be struck with the great number of cases of post-

menopausal bleeding that are not explained satisfactorily on examination of the endometrium obtained on curettage. In many of these cases *no hysterectomy is ever required*.

The one contraindication to curettage which we do observe is pyometra. If on cervical dilatation pus is encountered coming from the uterine cavity, the cervical canal is well dilated, and nothing more is done. The patient is given 300,000 units of penicillin twice daily for approximately a week. A few weeks later the cervix is dilated again. Penicillin is given twice daily for 2 days preceding this. If no pus is obtained a curettage is done. If pus is obtained again, curettage is deferred again, but eventually it will be done and the diagnosis established.

The author knows of no statistics nor does our experience bear out the belief expressed by Curtis that "the prognosis in curetted patients is unquestionably and definitely less favorable." On the contrary, we have seen needless hysterectomies done on bleeding postmenopausal women with benign conditions because a curettage was omitted. We do not post patients for operation as "curettage, possible hysterectomy." The inference in such a posting is that in case an abundance of suspicious-looking endometrium is obtained at curettage, a hysterectomy will be done immediately. The greatest pathologist can be fooled on the gross appearance of curettings. We insist on a microscopic examination of the tissue before deciding on definitive therapy. A delay of 48 hours is of no importance.

In the past several years postmenopausal hyperplasia of the endometrium has been recognized, and the question of its relation to endometrial cancer has been considered. It suggests that there is activity in the ovary in some women long after the menopause. In 2 cases of marked postmenopausal hyperplasia the author has observed peculiar luteinlike cells throughout the ovarian stroma. It was at least suggestive that these cells were the source of the postmenopausal estrogen. In many instances the endometrial pattern of hyperplasia after the menopause is indistinguishable from that which so commonly occurs before the menopause. In such cases there is no question of malignancy, but there are cases in which the glandular pattern



FIG. 252. Active-looking proliferative endometrial hyperplasia found in a woman 2 years after her last period. This is a part of the same endometrium shown in Figure 253, which is classified as adenoma malignum.



FIG. 253. Adenoma malignum. All gradations of change were found in this endometrium from proliferative hyperplasia shown in Figure 252 to the above picture of undoubted malignancy.

appears to be active and proliferative. The microscopic differential diagnosis may give rise to differences of opinion among the best of gynecologic pathologists, and almost every gradation between the benign hyperplasia and adenoma malignum has been seen. To illustrate this see Figures 252 and 253. When a definite pathologic diagnosis is not forthcoming, the clinician may be in a quandary. When faced with this dilemma the gynecologist is not usually in as bad a position as might appear to be the case. Inasmuch as the malignancy under consideration is of low grade, a short delay to permit another curettage is quite safe. The tissue obtained a month or two later may settle the issue. The clinical facts also help one to decide the proper course. If bleeding continues and if there is reasonable suspicion from the microscopic appearance of the tissue that the lesion *might* be malignant, probably it is better to proceed in the treatment on the basis of existing cancer. On the other hand, if all bleeding stops after the curettage, and if the second curettage shows no *definite* evidence of malignancy, close observation is permissible. The age and the general medical condition of the patient may also fairly be taken into consideration in considering radical therapy. For further consideration of the subject of the relation of endometrial hyperplasia to

endometrial carcinoma, see Chapter 26, "Functional Uterine Bleeding."

#### PATHOLOGY IN RELATION TO PROGNOSIS

Carcinoma arising from the endometrium is practically always adenocarcinoma. There is a variety of histologic types; Ewing has classified them as follows:

1. **Adenoma malignum**, the most frequent type, showing greatly enlarged and elongated alveoli, lined by several layers of cuboidal and cylindrical cells.
2. **Papillary adenocarcinoma**, a form that probably arises from superficial cells, resembling grossly the coarser papillomas of the bladder.
3. **Alveolar carcinoma**, a rare form showing solid masses of cells joining alveoli and smaller cell groups infiltrating spaces and vessels.
4. **Adeno-acanthoma**, in which squamous cells form a prominent element in adenocarcinoma and, in rare instances, predominate over the glandular structure.

Mahle, classifying 186 cases of corpus carcinoma at the Mayo Clinic, demonstrated that a definite relationship exists between the histologic pattern of the tumor and the surgical end-results. He divided the neoplasms into

4 grades of malignancy in a manner similar to Broder's classification of squamous-cell carcinomas:

**Grade 4** represents highly malignant tumors in which the cells show no differentiation throughout practically the entire tumor, although occasional areas may show some primary differentiation.

**Grade 3** represents carcinoma composed largely of undifferentiated cells, although some areas show some primary differentiation, and occasional areas show secondary differentiation.

**Grade 2** represents a group showing a predominance of secondary differentiation throughout and occasionally primary differentiation.

**Grade 1** comprises cases in which the carcinoma is extremely small, and the cells show high differentiation, secondary throughout.

In comparing the end-results from operation (abdominal and vaginal panhysterectomy) of the 4 groups, Mahle found that Grade 1 group contained the largest percentage of living patients: 100 per cent of only 6 patients. In the Grade 2 group, 71 per cent of the 85 patients were living. In the Grade 3 group, 38.09 per cent of 42 were living, and in the Grade 4 group all were dead. The length of time the patients were followed after operation varied from 2 to 15 years.

Healy and Cutler divided their cases at the Memorial Hospital into similar groups but used a different terminology; since it appears

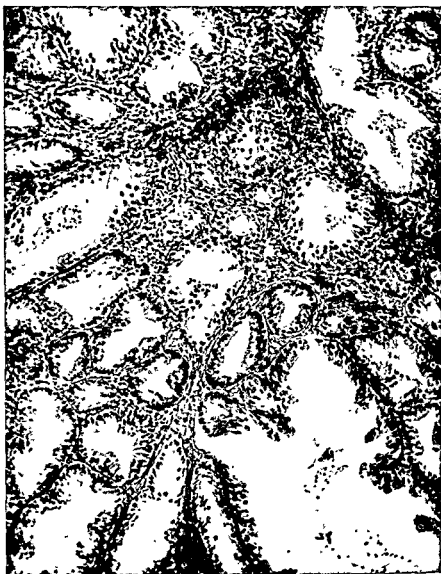


FIG. 254. Papillary adenoma malignum (Grade 1).

frequently in the literature, it is given here:

Papillary adenoma malignum, Grade 1 (Fig. 254).

Adenoma malignum, Grade 2 (Fig. 255).

Tumor cells forming solid masses, strands or cords, Grade 3 (Fig. 256).

Diffuse anaplastic carcinoma, Grade 4 (Fig. 257).



FIG. 255. Adenoma malignum (Grade 2).

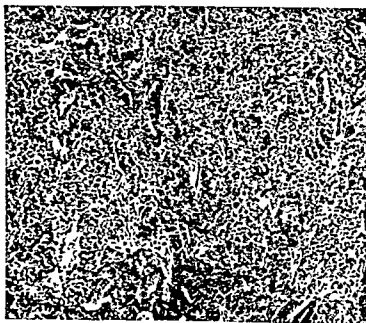


FIG. 256. Carcinoma of endometrium (Grade 3).

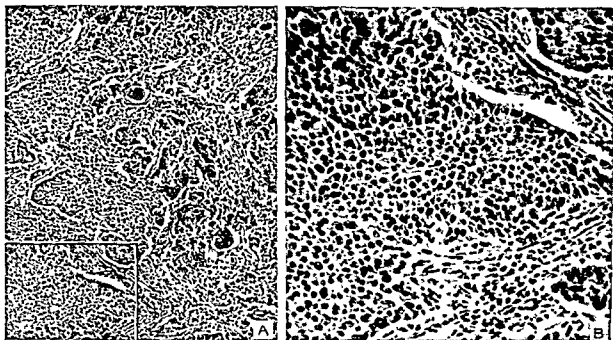


FIG. 257. Diffuse anaplastic endometrial carcinoma (Grade 4). (B) Shows enlarged section indicated by lines in (A).

Their follow-up study confirmed that of Mahle, indicating that the degree of clinical malignancy was parallel with the degree of histologic malignancy.

Although the writer agrees, in general, with the views of the above authors, one encounters difficulties in grading endometrial carcinomas on the basis of the histologic pattern. Grades 1 and 4 are recognized easily, and usually there is universal agreement among pathologists as to their place in the classification. Grades 2 and 3 offer more difficulty; frequently, their place in the classification is a matter of personal opinion on the part of the pathologist. Also, when many sections are cut from the same tumor, often there is great variation in the histologic pattern, and this makes classification difficult. In fact, in some tumors all 4 histologic types may be demonstrated.

When attempting to prognosticate from the histologic pattern, one never should lose sight of the fact that other clinical factors are of equal, or perhaps greater, importance. However, there is no clinical classification of endometrial cancer comparable with the staging of cervical cancer which is satisfactory. Many attempts have been made at staging preoperatively, but all have left much to be desired. Nevertheless, the extent of the

neoplastic process found on examination of the removed uterus is of considerable prognostic value.

#### CHOICE OF TREATMENT AND PROGNOSIS

The choice of treatment and prognosis should be considered together, because our ideas of the proper treatment have evolved from the results of follow-up studies made on groups of patients treated by various methods. The results of the early treatment by surgery were far better than those of carcinoma of the cervix. Cullen, in 1900, reported that 66 per cent of the cases operated upon were well in from 11 months to 6 years after operation. These patients were operated upon by abdominal or vaginal hysterectomy. Mahle, in 1923, reported that 50 per cent of the patients who had undergone vaginal hysterectomy were well, as were 55 per cent of those upon whom abdominal hysterectomy was done. These figures represent the percentages of operated patients "well" at the time of the report and are not to be compared with 5-year "cure" statistics found in later literature. The operative treatment for carcinoma of the corpus uteri has become standardized as abdominal total hysterectomy with bilateral salpingo-oophorec-

tomy. In recent years there have been some who have advocated the routine use of pelvic lymphadenectomy at the time of the hysterectomy. We are not inclined to agree with this, because the spread is often into the aortic chain of glands. Only if enlarged glands are palpable in the pelvis and the aortic glands are negative would we be inclined to do a pelvic lymphadenectomy or when the uterus opened in the operating room shows cervical involvement.

The vaginal extirpation is done occasionally, but in our opinion it should be performed only in the very obese or in certain cases associated with marked relaxation and prolapse. In case the malignancy has invaded well into the myometrium, the uterine wall may easily be torn in attempting to deliver the fundus per vaginum. This accident is disastrous in that it almost certainly precludes a cure. On reviewing the results in those patients treated by surgery alone in the early years, it becomes evident that about half of the patients fail to survive 5 years. Yet one must remember that these statistics are based only on the operable cases and thus cannot be fairly compared with today's statistics which embrace all, or nearly all, cases seen.

The mortality of the hysterectomy for corpus carcinoma is somewhat in excess of that for benign disease. Norman Miller gives an operative mortality of 3.5 per cent. This increased mortality probably is due to the fact that many of the patients are of advanced age and some are found at operation to have more advanced disease than was expected preoperatively.

Because the operative results were so much better than those of carcinoma of the cervix the surgeons were loath to surrender the cases for irradiation therapy. At first only the inoperable cases were treated with irradiation, but it soon became obvious from the results with these alone that irradiation was of considerable value. For example, Burnam reports a 5-year cure rate of advanced inoperable cases of 12.9 per cent. For a group of patients, including inoperable cases, cases that were not operated upon for general medical conditions and a few patients who refused surgery, Miller reports a 5-year survival rate of 37.5 per cent. The results of treatment by irradiation alone in a group of cases of all

stages are well demonstrated by Heyman's report from the Radiumhemmet; it showed a 5-year survival rate of 43.5 per cent of all cases. When only the operable cases were considered, a 5-year "cure" rate of 60 per cent was attained. Heyman's technic included intra-uterine irradiation and roentgen irradiation. Burnam reported a 5-year survival rate of 55 per cent in patients treated only by irradiation.

In spite of these relatively satisfactory results with irradiation, it soon became evident from examination of uteri removed at operation following irradiation that in over 50 per cent of the cases, active-looking carcinoma could be demonstrated. Hundley *et al.* found residual carcinoma in 71.7 per cent after 4,000 to 4,500 mg. hours of intracavitary irradiation. Arneson found active disease in every uterus treated with less than 3,000 mg. hours of radium. On reviewing the effect of irradiation it becomes obvious that the greater the irradiation dosage the higher is the incidence of freedom from residual cancer. Schmitz *et al.*, who employ a total of 6,000 mg. hours plus deep x-ray therapy, report an absence of viable cancer cells in 77.4 per cent. We attempted intracavitary irradiation plus x-ray preoperatively several years ago but found the incidence of complications, such as bowel injury, too great to justify the practice routinely.

In the previous editions of this book it was stated that the treatment of choice for corpus carcinoma "is preoperative irradiation followed by total hysterectomy and double salpingo-oophorectomy." In the opinion of the author this statement is still true, but it is only fair to state that the question of preoperative irradiation is controversial. Treatment today in the better clinics varies between surgery alone and surgery combined with irradiation given by various methods. The following are some of the variations in common use today:

Surgery alone.

External irradiation followed by surgery.

Intracavitary irradiation followed by almost immediate surgery.

Intracavitary irradiation and x-ray followed by surgery.

It is difficult to assess the results of these different forms of therapy and make a final

judgment as to the best one to follow, because there is a great variation in clinical material in different clinics. In clinics in which there is a predominance of public ward patients the cases are more advanced, and the results naturally are not as good as in those clinics in which the patients are predominantly private. In our own clinic the results have been much better in the white than in the colored race due to earlier detection. In spite of several unknown factors which affect results the following figures are given for consideration of the reader.

#### STANFORD HOSPITAL (1940-1954, McLENNON)

	5 year salvage
Surgery alone	86.5%
Irradiation and surgery	89.2%
Irradiation alone ..	56.0%
Total . . . . .	81.0%

#### JEFFERSON HOSPITAL (SCHEFFEY AND MONTGOMERY)

	5 year salvage
Adequate surgery	75.0%
Planned preoperative intracavitary irradiation and surgery	86.0%
Intracavitary irradiation and x-ray	45.0%
X-ray alone	0.0%
Total (including inadequately treated cases)	64.9%

#### SCHMITZ, SMITH, AND FETHERSTON

Intracavitary irradiation, x-ray and surgery (1934-1945)	47.4%
Intracavitary irradiation, x-ray and surgery (1946-1953)	67.0%

From the above recorded results McLennon concludes that "preoperative radium routinely would not have been of real benefit in our patients."

Scheffey and Montgomery conclude that the best treatment is preoperative intracavitary irradiation followed by surgery in 6 weeks.

Schmitz *et al.* believe that preoperative intracavitary and external x-ray are worthwhile preceding surgery and that even though the tumor cells are not completely destroyed, the irradiation retards the spread of tumor.

From statistics such as those quoted above as well as our own experience we have chosen to irradiate most of our cases of endometrial cancer and follow with total hysterectomy and double salpingo-oophorectomy 6 weeks later. The results with irradiation are statistically only slightly better in most series, and one might ask if they are statistically significant. When dealing with malignancy it would seem logical to use all weapons at our disposal, provided that the weapons are not dangerous. Intracavitary irradiation, when properly given, is quite innocuous, and since in quite a large percentage of the cases cancer cells are apparently completely destroyed, it seems wise to give this added thrust to our therapy. Also, the fact that a reasonably large percentage of women treated by irradiation alone remains well for 5 years also testifies as to the effectiveness of irradiation in many cases. The reason for waiting 6 weeks before surgery may be questioned, but it would appear that waiting for this period would permit a sclerosing effect on the endometrium, thus reducing the possibility of implanting viable tumor cells in the vaginal vault. Since the author has been using preoperative irradiation he has seen no recurrences in the vaginal vault. During the same period of time he has observed several vaginal-vault recurrences in women operated elsewhere, none of whom had had preoperative irradiation. On the other hand, we recognize that vaginal recurrences are not all the result of implantation, for they are seen frequently in the suburethral region where they undoubtedly occur through lymphatic transmission.

Although preoperative intracavitary irradiation followed by surgery is our usual treatment, we do make a few exceptions. In some of the early cases of very low grade histologic malignancy we proceed with hysterectomy directly. In such cases the cervix is always closed by suture before the laparotomy. In these cases it is difficult for us to believe that irradiation would increase the curability rate. We believe that the knowledge gained from a histologic examination of the specimen is of greater value prognostically than the use of preoperative irradiation. If such a study shows that we have misjudged the case and that the myometrium is deeply invaded, one can use postoperative x-ray treatment.

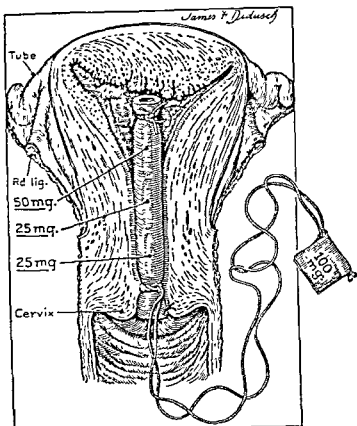


FIG. 258. Application of radium for carcinoma of corpus uteri.

In a disease occurring predominantly in elderly women one occasionally encounters it in a very old person of poor operative risk and probable very short life expectancy. In such cases we give intracavitary irradiation. The case can be followed by curettage if bleeding recurs; and if viable malignancy is found, further intracavitary or x-ray irradiation may be given.

#### TECHNIC: PREOPERATIVE IRRADIATION FOR CANCER OF THE CORPUS UTERI

The diagnosis of corpus carcinoma having been established by curettage and histologic examination of the tissue, intracavitary radium is applied. When the curettage is done the length of the uterine cavity is determined, and often one can obtain valuable information as to the location and the extent of the endometrial involvement. This may be valuable in helping to decide the arrangement of the intracavitary application of radium capsules. In the average case 3 cap-

sules arranged in rubber tubing are inserted into the cavity of the uterus with the applicator shown in Figure 258. It is our custom to place the 50-mg. capsule in the distal end of the tube, followed in tandem by 2 capsules of 25 mg. each (Fig. 258). The 50-mg. tube is placed in the fundus, as there is a larger area of endometrium to be covered there. If the cavity of the uterus measures 9 to 10 cm. in length, it may be well to use 4 capsules of 25 mg. each in tandem in order to cover the cavity more completely. The proximal end of the rubber tubing is sutured with linen or heavy silk to the cervix, and the vagina is packed with sufficient gauze to distend it tightly. This not only gives further support to the intra-uterine tube but also pushes the bladder and the rectum as far as possible away from the source of irradiation. An indwelling type of catheter is placed in the bladder, and the radium is left in for 48 hours. Thus a total dosage of 4,800 mg. hours is given.



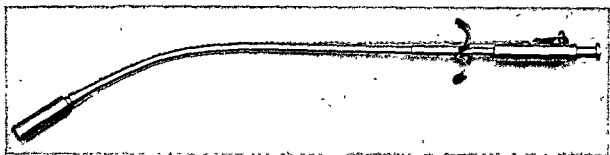


FIG. 259. Heyman screen applicator. The capsule at the tip contains the radium which is released after being inserted.

If at curettage the cavity is found to be very large and a great abundance of friable carcinoma tissue is obtained, it is advisable to use the Heyman multiple applicators, each with 10 mg. of radium, in order to get a better distribution of irradiation (Fig. 259). The total dosage should be the same.

As suggested by Scheffey, it is well to have radium ready for insertion in all cases in which endometrial cancer is seriously suspected when the curettage is done. If the endometrium is grossly suspicious of malignancy, or if irradiation is desirable for an existing benign lesion such as functional bleeding or a small fibroid, radium is inserted. The tissue is rushed through the laboratory; and if no malignancy is found, the radium is removed at such time as to deliver approximately 2,000 mg. hours. If endometrial cancer is found, the radium is left in for 48 hours. This routine is of particular value in women in the menopausal years when irradiation for a benign lesion is desirable as well as for corporeal cancer. Before the patient leaves the hospital arrangements are made for her readmission 6 weeks hence for surgery in case endometrial cancer is found.

In those cases of corpus carcinoma where bimanual examination or palpation of lymph glands indicates a spread of the malignancy beyond the uterus the treatment is limited to a full course of intra-uterine irradiation and roentgen therapy. When, because of age or the general physical condition, surgery is contraindicated, the patients are similarly treated. Occasionally, endometrial carcinoma is encountered in elderly women of poor operative risk. In such women we give a full dosage of irradiation, and after a few months per-

form a curettage. If the curettings show viable cancer, the decision to perform a hysterectomy is usually made in spite of the known operative risk. Finally, there are those cases in which unsuspected endometrial cancer is found in the laboratory when hysterectomy was done for a supposedly benign condition and either the cervix, adnexa or both were not removed. The next move depends upon the age and the general condition of the patient and the extent of the lesion. If the patient is in good condition and not too elderly, reoperation with removal of the cervix and the adnexa had best be done. If the lesion is located high in the uterine cavity, it is probable that the residual cervix constitutes less risk to the patient than the remaining adnexa. Radium placed in the cervical stump may be quite adequate, but if the abdomen is opened for removal of the adnexa the cervix should be removed. If age or the medical condition of the patient makes further surgery inadvisable, one must rely entirely on roentgen therapy.

#### TECHNIC: TOTAL HYSTERECTOMY FOR CARCINOMA OF THE CORPUS UTERI

It is our custom to carry out total hysterectomy and double salpingo-oophorectomy as described below. Within the last few years the question of more radical surgery with pelvic lymph-gland dissection for this disease has been considered and carried out by a few surgeons. The high percentage of cures without this radical surgery indicates to us that to treat the disease in this manner routinely would be overtreatment, since most endometrial cancer is confined to the uterus at the time of treatment. The postoperative com-

plications attending the radical surgery would outweigh the possible slight increase in salvage. In addition, the spread of corporeal cancer is more often via the preaortic lymphatics than by those in the pelvis. An exploration by palpation of the pelvic and the abdominal glands should be carried out at the outset of the operation routinely. If the abdominal glands are obviously involved, it is clear that radical surgery in the pelvis is of no use. If glands in the pelvis are involved, or even suspicious, lymphadenectomy is indicated in addition to the surgery described below. Also, in those cases in which the cervix is found to be involved on opening the specimen in the operating room, it may be advisable to do a lymphadenectomy.

A few precautions should be taken when total hysterectomy is done for endometrial cancer. The patient is first put in the lithotomy position, and the two lips of the cervix are closed with a figure-of-eight of chromic catgut. This procedure reduces the chance of squeezing out viable cancer cells and also lessens the chance of infection, for the uterine cavity may be heavily infected.

When the abdomen is opened, the fallopian tubes are either ligated or clamped to pre-

vent the retrograde passage of carcinomatous material while handling the uterus. The tubes and the ovaries are always removed, regardless of the age of the patient or the early stage of the growth. Since the broad ligaments, the tubes and the ovaries are so liable to extension via the lymphatics, no chance should be taken by leaving adnexa in. The total hysterectomy differs slightly from that described in this volume for benign uterine disease. The cervix is not hugged quite so closely when clamping the base of the broad ligament, and the pubocervical fascia is not stripped from the cervix and the vagina. This fascia is rich in lymphatics, and its removal would seem to be desirable in those cases in which the corpus carcinoma is low in the uterus. As in hysterectomy for benign uterine disease, we usually close the vagina without drainage.

On rare occasions endometrial carcinoma will be discovered when the uterus is opened in the operating room, following a hysterectomy for supposedly benign uterine disease. If the cervix or the adnexa on either side have not been removed, they should be taken out before the abdomen is closed.

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## Sarcoma of the Uterus

Sarcoma of the uterus has been recognized as a pathologic entity since 1860, when the first recorded case was presented by C. Meyer to the Berlin Obstetrical Society. It is a relatively rare condition. Novak and Anderson reported an incidence of 3.1 per cent of uterine malignancies in the gynecologic pathologic laboratory at The Johns Hopkins Hospital over a 25-year period. Kimbrough reported an almost identical incidence of 3.2 per cent. The disease most frequently occurs in middle life, the greatest incidence being in the fifth decade. On the other hand, sarcoma botryoids usually occurs in infants, while endometrial sarcoma often occurs in the elderly. The symptomatology is not distinctive. Bleeding or blood-tinged discharge is the usual presenting symptom, but when the sarcomatous change occurs in the depths of a myoma, there may be no bleeding or abnormal discharge.

Sarcoma of the uterus may have its origin in one of four sites and, according to its origin, presents a variety of clinical pictures:

1. *Sarcomatous change in myoma.* This is the largest group, although the incidence of malignant change in fibroids is very low.

2. *Sarcoma of the endometrium.* The incidence of this type of uterine sarcoma is next to that of sarcomatous change in myoma but still must be considered a rare disease. The carcinosarcoma (mixed mesodermal tumor) arising from the endometrium will be considered separately in this chapter.

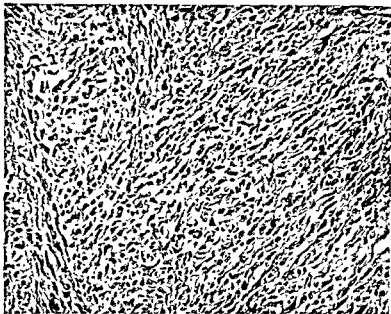
3. *Sarcoma arising in the musculofibrous wall of the uterus.* This rare tumor appears in some instances to arise from the musculofibrous coat of the blood vessels as judged by the perivascular arrangement of the sarcoma cells. In the majority of these cases it is scarcely possible to guess the exact origin of the neoplasm when it finally gets into the hands of the pathologist.

4. *Sarcoma of the cervix* may be grape-

like, forming the so-called sarcoma botryoids, or may be ulcerative, being grossly indistinguishable from carcinoma.

To the surgeon a very important point is concerned with the recognition of sarcoma at the operating table, for the recognition of the lesion may dictate radical surgery rather than a more conservative procedure. Sarcomatous change in myomas may be obvious at the operating table, but often the malignant change is confined to the central portion of a perfectly normal-appearing large fibroid. As the sarcomatous growth continues, the outer surface of the myoma is invaded and changes in appearance. Instead of the smooth glistening fibrous capsule the surface becomes dull and more irregular, suggesting that malignant tissue growing from within has penetrated the pre-existing capsule. The neoplastic tissue soon invades surrounding structures and becomes adherent. Independent nodules in the omentum, the lymph glands and the liver may clearly indicate metastatic sarcomatous growths. The consistency of the sarcomatous growth is usually softer than that of the average fibroid, but, as every experienced operator knows, benign fibroids can be remarkably soft. If in doubt, the tumor should be cut by an assistant in the operating room after removal. Instead of the firm, glistening cut surface and the whorl-like appearance of the fibrous tissue in the ordinary fibroid, the surface of the sarcoma may have a homogeneous, raw porklike appearance. In some instances the malignant tumor may have become necrotic, and broken-down friable areas replace the solid tissue. If one scrapes the cut surface of a benign fibroid with a knife blade, a sharp, scraping sound is heard, and no tissue collects on the blade. Scraping of the softer sarcomatous tissue causes no sound, and pul-taceous material may collect on the knife blade.

FIG. 260. Sarcomatous change in myoma.



Intramural sarcoma, arising directly from the musculature or the fibrous tissue of the uterine wall, may cause a symmetrical uterine enlargement, but as the growth continues the malignant tissue breaks through the serous surface, creating irregularities of the surface.

Endometrial sarcomas usually grow into the uterine cavity in a polypoid manner. Often they advance downward through the cervical canal and into the vagina. We have encountered a few that have practically filled the vagina. In such instances the diagnosis may be strongly suspected from the chicken-fat color of the tissue, which is very friable

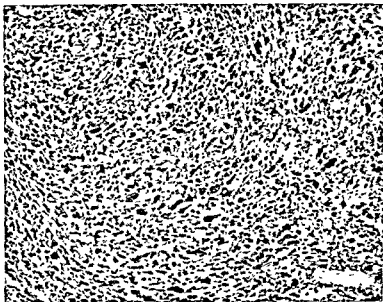
and easily torn through with the examining fingers.

Cervical sarcoma may present a sloughing, ulcerated appearance much like that of advanced cervical cancer. Sarcoma botryoids, which occurs more often in infants than in adults, extends into the vagina like multiple, pinkish and edematous grapelike polyps.

### HISTOLOGY

Most of the bizarre cellular changes found in malignant connective tissue tumors elsewhere in the body are found in uterine sarcoma. Wide variations in cell types are fre-

FIG. 261. Sarcoma in endometrium.



quently seen in different parts of a single tumor. Round and spindle cells are commonly found in the same tumor, and it is probable that the "round cells" are the result of cutting bundles of spindle cells transversely. Hyperchromatic nuclei are common, and mitotic figures may be rare or exceedingly frequent. Figure 260 shows sarcomatous change in a fibroid, and Figure 261 represents sarcoma arising in the endometrium. Giant cells with huge, dark-staining nuclei are common in sarcoma arising in myomas. They may represent abnormal cellular activity, but equally often they appear to be the result of a degenerative process with cytoplasmic confluence of degenerating cells. In attempting to correlate the microscopic picture with clinical malignancy it has been shown that even a great number of giant cells is not necessarily indicative of a grave prognosis. In 1920 Evans, of the Mayo Clinic, studied a large number of "malignant myomas" and made quantitative mitotic figure counts on many microscopic fields of uniform thickness. He concluded from a follow-up study of the cases that malignancy was in direct proportion to the number of mitotic figures. Novak and Anderson's study confirms that of Evans. However, we have examined microscopically metastatic sarcomatous nodules in the liver and found mitotic figures to be completely absent. The cases about which there is greatest confusion are those fibroids in which there is little or no nuclear activity but which are exceedingly cellular. The difference in the interpretation of these tumors undoubtedly accounts for the great difference in the incidence of malignancy reported in fibroids. An incidence up to 4 per cent has been reported, but that figure is undoubtedly too high. More critical pathologists such as Evans, from the Mayo Clinic, and Novak and Anderson, from Johns Hopkins, report an incidence of 0.7 per cent and 0.56 per cent, respectively. However, it must be remembered that these calculations are based on the fibroids which reach the laboratory. Since they represent only a small proportion of the existing fibroids, the percentage of sarcomatous change in fibroids must be even smaller. That the incidence of malignancy is small is confirmed further by the great paucity of sarcomas appearing after irradiation of presumably benign tumors.

## DIAGNOSIS

The preoperative diagnosis of uterine sarcoma may be easy or difficult, depending on the type. Endometrial sarcoma may be suspected when a relatively large, friable, polypoid mass presents itself through the dilated cervix into the vagina. It must be differentiated from the sloughing, submucous fibroid which is usually of firmer consistency and does not have the yellowish appearance of sarcoma. The polypoid type of sarcoma arising from the cervix may be suspected when a relatively large friable polypoid mass can be seen attached to the cervix. Removal of the polyps for biopsy will establish the diagnosis. Sarcomatous change in a fibroid may be suspected when there is evidence of rapid growth in a fibroid at any age, but when there is unquestionable postmenopausal growth in a fibroid, sarcomatous change is almost certain. If the sarcomatous change is near the uterine cavity, postmenopausal bleeding may occur, and a diagnostic curettage should be done. Finding sarcomatous tissue in the material obtained at curettage establishes the diagnosis, but the absence of sarcomatous tissue by no means rules out the possibility, as the degenerative process is often in the center of the tumor. More often, bleeding from the postmenopausal fibroid uterus indicates coincidental malignancy of the cervix or the endometrium.

## TREATMENT

The treatment of uterine sarcoma is usually radical surgery, supplemented in some instances by irradiation. However, there must be individualization, depending upon the type of sarcoma, the extent of the disease, the general condition of the patient and whether or not the diagnosis is made preoperatively.

Let us consider first the sarcomatous fibroid or intramural sarcoma arising directly from the fibromuscular wall of the uterus. These conditions may have been diagnosed preoperatively, but it is more likely that the surgeon will be confronted with the condition after the abdomen is open. If possible, the surgeon should perform a total hysterectomy and a double salpingo-oophorectomy. An omentectomy is probably desirable whether it is grossly involved or not. The liver should be palpated, and a search should be made throughout the abdomen for lymphatic en-

largement. Even if extension beyond the uterus is found, it may be advisable to perform the radical pelvic surgery if it can be done without too great risk. This may facilitate the postoperative x-ray therapy. The extent of the growth with involvement of surrounding structures may make complete surgery impossible and, indeed, may only permit the removal of a specimen for biopsy. Following obviously incomplete surgery, deep x-ray therapy to the abdomen and the pelvis may be carried out unless the extent of the disease and the general condition of the patient are such as to make the disadvantages of irradiation outweigh the possible benefits. In case of complete surgery with sarcomatous change limited to the central portion of a large fibroid and particularly when the malignancy appears histologically to be of low grade, it is our custom not to follow the surgery with irradiation. The value of x-ray therapy is far from established, and radical surgery remains the backbone of treatment.

Every surgeon who has done a large number of hysterectomies for fibroids is confronted eventually with a pathologic report of sarcoma in a fibroid uterus which he presumed to be benign at the operating table. If a subtotal hysterectomy was done or adnexa left in, the question of further surgery presents itself. We are inclined against further surgery. If the sarcoma is found high in the uterus and well away from the level of amputation, it is probable that the chances of cure are almost as good with subtotal as with the total operation. If the sarcoma is found low in the uterus, radium may be placed in the cervical stump and deep x-ray therapy given to the pelvic region. Irradiation by means of x-ray is also indicated if the adnexa have not been removed.

Sarcoma of the endometrium probably should be treated with intracavitary irradiation, followed in 6 weeks by total hysterectomy and double salpingo-oophorectomy. We never have seen an endometrial sarcoma cured with intracavitary irradiation alone. The tumor frequently melts away with irradiation but in our experience invariably recurs; hence, the necessity of the hysterectomy. If the polypoid mass of sarcoma is large, extending into the vagina, the greater part of it should be curetted away before radium is applied. Because such a polypoid



FIG. 262. Mixed mesodermal tumor of endometrium. Glands and stromal elements both appear to be malignant. Note cartilage which is occasionally found in these very malignant tumors.

mass is always infected, penicillin, or a similar antibiotic, should be given when the tissue is removed and at the time of irradiation.

Sarcoma of the cervix should be diagnosed by biopsy. If the lesion is polypoid, biopsy consists of removal of the polyps. Irradiation in dosage comparable with that given for cervical cancer should be used, followed in most instances by hysterectomy with a generous vaginal cuff. Age or a generally poor medical condition may contraindicate the surgery. No one has had sufficient experience with this rare disease to justify a too-dogmatic opinion on treatment.

It is impossible to obtain any statistical data regarding prognosis in sarcoma of the uterus based on any set routine of treatment. Kimbrough has reported 34 per cent 5-year cures, and Novak and Anderson 30 per cent. The latter percentage was reduced to 24 per cent after 5 additional years. These survival rates are based on a variety of methods of treatment, such as total hysterectomy or subtotal hysterectomy with and without postoperative irradiation as seemed to be advisable in each individual case.

## THE MIXED MESODERMAL TUMOR

The histogenesis of the mixed mesodermal tumor is obscure. The term "carcinosarcoma" has often been applied to these tumors in which malignant connective tissue and epithelial elements are both present (Fig 262). Most gynecologic pathologists are convinced that the lesion is a real entity containing both sarcomatous and carcinomatous elements and not merely a collision of two separate tumors. Rubin has concluded from tissue culture that there are two distinct cell types. One cell type had the characteristics of carcinoma, the other of sarcoma. No intermediate cell types or evidence of transition from one form to the other was seen. The tumors often contain a variety of mesodermal elements such as striated muscle fibers and cartilage. Clinically, the tumor grows in polypoid form within the uterine cavity, often presenting into the vagina through the cervical canal. The lesions usually metastasize early, quite in contrast with the usual carcinoma of the endometrium. Their great malignancy is indicated by the

fact that some series are reported with no 5-year survival. For example, Sternberg, Clark and Smith reported 21 cases from the Charity Hospital in New Orleans with no 5-year survivors—the longest survivor being 27 months after the appearance of symptoms. However, all reports are not that pessimistic. Symmonds and Dockerty reported 19 cases from the Mayo Clinic with 4 survivors for 5 years.

Because of the generally poor results the pattern of treatment is not certain. It has been our custom to give approximately 5,000 mg. hours of intracavitary irradiation, followed by hysterectomy. If evidence of extension is found at operation, the surgery is followed by a full course of deep x-ray therapy. Of the 4 surviving cases at the Mayo Clinic, 2 had total hysterectomy without x-ray therapy, and the other 2 had total hysterectomy with x-ray therapy. Of course, the adnexa are removed with the uterus, but since metastases are usually distant, one wonders how much is accomplished by the adnexectomy.

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# Functional Uterine Bleeding

## GENERAL CONSIDERATIONS

There is considerable confusion in the literature as to the definition of functional bleeding, so perhaps it is of some importance that it be defined in the sense in which it is used in this chapter. Functional uterine bleeding is pathologic bleeding from a uterus, unexplained on the basis of inflammation, neoplasm or pregnancy within the uterus. According to this definition, an organic lesion may be present in the generative organs outside of the uterus when the bleeding from the uterus is entirely functional in nature. Indeed, this is the case in some instances when bleeding is associated with granulosa and theca-cell tumors of the ovary. It is also the case when abnormal bleeding is associated with a corpus luteum retention cyst of the ovary. However, in the vast majority of cases of functional uterine bleeding, no gross pathologic lesion is present in the ovary. Hamblen excludes by definition those cases in which the bleeding is associated with some obvious endocrine disorder. By his definition, bleeding associated with hypothyroidism would be excluded; by our definition it would be included.

There is also some confusion in the literature as to the proper name for this condition. Several authors prefer the term "dysfunctional bleeding," since in a strict sense menstruation is a form of functional bleeding. There is much to be said for this argument, but the term "functional bleeding" has been so generally used that to attempt to change the name now probably would only lead to confusion.

Functional bleeding may appear as almost any type of abnormal bleeding. Menorrhagia is common. It may be an increase in the profuseness of the menstrual flow, an increase

in duration, or both. A frequent history is that of a gradual increase in profuseness and duration, the periods becoming longer and longer until they finally merge with one another, and the bleeding is continuous. Periods of several weeks of amenorrhea between bleeding spells are common. Intermenstrual spotting or profuse bleeding may also be of a functional nature, and even postmenopausal bleeding occasionally falls in this category. It is with hesitancy that we make the last assertion, because the vast majority of cases of postmenopausal bleeding have an organic basis, and they should be considered as of organic origin until proved to be otherwise. Nevertheless, at times postmenopausal functional bleeding is associated with ovarian neoplasms, especially those of the feminizing type and rarely is it encountered without demonstrable adnexal pathology. However, functional bleeding in general should be looked upon as a disease of reproductive life. Its years of greatest incidence are those between 40 and the menopause, although we have seen it frequently at all ages of menstrual life. Of special note are those cases occurring in children of the "teen" age. We have noted it as early as 12 years and much earlier when associated with granulosa cell tumors of the ovary. When bleeding is noted before the age of normal puberty, the possibility of a feminizing tumor always should be considered, especially if there are other signs of precocious puberty.

The pathologic endometrial picture associated with functional uterine bleeding has been studied extensively. One obtains from the literature the impression that many gynecologists formerly assumed that functional bleeding was invariably associated with endometrial hyperplasia. This point of view is



FIG. 263. Endometrial hyperplasia from a functional bleeder.

no longer tenable, for there is now overwhelming evidence that any type of endometrium may be found with this clinical syndrome. Keene and Payne found hyperplasia present in 60 per cent of their cases of functional bleeding. Jones, in a study made in our laboratory, found hyperplasia present in 63 per cent of the cases (Fig. 263). There

was secretory endometrium in 17 per cent of Jones's cases (Fig 264) and nonsecretory endometrium of the interval, postmenstrual or atrophic type in the remaining 20 per cent (Fig. 265). Thus, in at least 17 per cent of this series normal cyclic changes were taking place in the endometria, and it is probable that many which showed the post-



FIG. 264. Secretory endometrium from a functional bleeder.

menstrual type of endometrium would have shown secretory glands had they been curetted later in the cycle. That functional bleeding can be associated with an exaggerated progestational picture or even decidua-like picture was shown by the study of Henricksen and Te Linde. In examining curettings and uteri removed for bleeding, they found several endometrial specimens in which there were full or partial decidua-like changes (Fig. 266). In some of these there was conclusive evidence that neither intra- nor extra-uterine pregnancy was present; in others there was strong presumptive evidence.

Since functional bleeding may be present in association with such a variety of microscopic pictures, it is obvious that the bleeding is not inherently bound up etiologically with the microscopic picture. It also becomes apparent that the actual causal mechanism of the excessive and/or irregular flow is not understood.



FIG. 265. Nonsecretory, but nonhyperplastic, endometrium from functional bleeder.

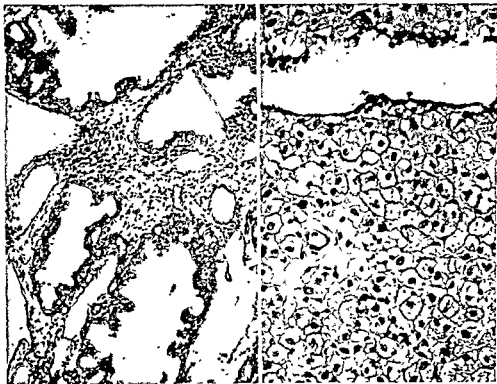


FIG. 266. Endometrium with decidua-like change from functional bleeding unrelated to pregnancy.

## PATHOLOGY OF ENDOMETRIAL HYPERPLASIA

Since hyperplasia is the most frequent condition of the endometrium associated with functional bleeding, and since a thorough acquaintance with its pathology is so essential, its gross and microscopic picture is discussed here in some detail. The condition was first described by Cullen in 1900, and the name "hyperplasia" was suggested by Welch, who concluded that the condition represented a true hyperplasia of the glandular and the stromal elements. In the original case described by Cullen a great quantity of endometrial tissue was obtained by curettage. We have seen repeatedly as much tissue at curettage as when endometrial carcinoma is present. In fact, many a surgeon, inexperienced in pathology, has proceeded with hysterectomy on the assumption that he was dealing with malignancy. Yet, there is usually a difference, grossly, between hyperplastic and neoplastic endometrium; the former is spongy and the particles smoothly rounded, whereas when such a quantity of tissue is obtained from a carcinomatous endometrium the fragments are friable and often necrotic-appearing. In some instances in which we have had the opportunity of examining the entire uterus we have found a polypoid overgrowth of the endometrium throughout the cavity of the corpus which ends abruptly at the internal os. In contrast with this, endometrial carcinoma is no respecter of physiologic barriers, and if it is present in the lower portion of the endometrial cavity it probably will invade the cervical canal. In some specimens the excessive endometrium is built up into a localized polyplike structure, and the remainder of the endometrial surface is relatively smooth. However, it was shown by Novak and Martzloff that in the majority of cases (19 of their 29) the endometrium is smooth and not abnormally thickened. In these cases no excess of endometrium is obtained on curettage, and the particles of endometrium do not differ, when seen without the microscope, from normal endometrium. However, this endometrium, which is not increased grossly, may have as hyperplastic a microscopic picture as the endometrium when a great excess of tissue is present.

## MICROSCOPIC PICTURE

The diagnosis of endometrial hyperplasia is made with certainty only microscopically. The most characteristic histologic feature is the gland pattern. The glands show marked variation in size and shape (Fig. 263). Novak has appropriately called this the "Swiss cheese" pattern. When the glands are cut in cross section, small round glands are interspersed with large ones, some of which are round and others of bizarre shape. The sawtooth pattern characteristic of premenstrual or early pregnancy glands is never present. The gland pattern of hyperplastic endometrium is similar to that seen in the basalis of the normal endometrium which is apparently uninfluenced by the progesterone that is responsible for premenstrual and early pregnancy changes in the functional layers of the endometrium. The epithelial cells lining the glands are usually taller than the normal ones and have deeply staining nuclei. Usually, there is no evidence of glandular secretion, but occasionally a little is seen. Mitotic figures are not uncommon in the epithelial elements. The epithelial lining of most of the glands is composed of a single layer of cells, but the appearance of stratification of the columnar cells is not uncommon. Plaques of squamous-like epithelial cells in hyperplastic glands are seen occasionally, as described by Englehorn, Sitzenzfey, Polano and Meyer. This marked proliferation or piling up of cells has brought up the question of malignancy in such cases, but there is ample proof in the reports of the above authors that this does not signify cancer.

The stroma of hyperplastic endometrium is usually dense and gives the appearance of true hyperplasia of the cellular elements. However, this stromal change in most cases is not as marked or as characteristic as the glandular change, and in some cases with marked glandular hyperplasia there is little alteration of the normal stroma. On the other hand, instances are encountered occasionally in which the stroma is extremely dense and the gland changes relatively slight. Mitoses may be present in the stromal cells, especially in the cases with marked hyperplasia of the stromal elements.

In addition to the microscopic pictures of undoubted hyperplasia described above, one

FIG. 267. (A, top) Hyperplastic endometrium from postmenopausal bleeder. This is somewhat proliferative but certainly benign. (B, bottom) Markedly proliferative hyperplastic endometrium from postmenopausal bleeder. Such a picture is very controversial and possibly may represent a low-grade adenoma malignum.



often finds another picture in curettings from functional bleeders in which there is little real evidence of hyperplasia of either the glandular or the stromal elements. The gland pattern resembles that of the postmenstrual or interval phase of the normal cycle, and there is a complete absence of evidence of secretion. Probably these cases are closely related to the true hyperplasia in that they have in common a complete lack of evidence of ovulation and corpus luteum influence. It is important from the standpoint of therapy to recognize this group and its relation to true hyperplasia.

Finally, it must be recognized that there is an atypical group of endometrial hyperplasias in which the epithelial proliferation is

of such a degree and nature as to simulate adenocarcinoma (Fig. 267A and B). Such cases may occur both before and after the menopause, but rarely in young women. The fact that many of these cases have remained well after simple curettage proves them to have been benign. On the other hand, we have observed the diagnosis of hyperplasia, made on repeated curettage, when finally, on a subsequent curettage, true adenocarcinoma was revealed. A review of the earlier sections in such cases usually demonstrates that a diagnosis of carcinoma would have been justified from the earlier sections. The possible relationship of atypical hyperplasia to endometrial cancer is considered in this chapter.

## ETIOLOGY OF HYPERPLASIA

From our knowledge of the histology of the various endometrial pictures associated with functional bleeding it is obvious that the endocrinologic disturbance responsible for all cases of functional bleeding is not identical. From the standpoint of etiology, the group showing the endometrial picture of hyperplasia is the most homogenous.

Closely related to this group are those cases with nonsecretory endometrium without true hyperplasia. Probably endometrial hyperplasia is a disease of hypophyseal-ovarian relationship, but the exact disturbance of this mechanism is not understood.

Formerly, it was generally accepted that the abnormality was a state of hyperestrogenism. That such a simple state of affairs does not always exist is evident from the fact that one cannot demonstrate in every case an excess of the estrogenic hormones in the urine or the blood. Furthermore, Burch has offered abundant evidence from animal experimentation to indicate that endometrial hyperplasia may result from various degrees of ovarian insufficiency. Such evidence seems to demonstrate that the endocrine background that results in bleeding from endometrial hyperplasia is not always the same.

Studies made by Schröder, Meyer, Novak and Martzloff on the histology of the ovary are interesting and fundamental. Although these studies are limited in that they simply present one histologic link in the chain of disturbed pituitary-ovarian physiology, they give us an anchor of definite information to which we may cling while groping for a complete physiologic understanding of the etiology of hyperplasia. In the 54 cases studied by Schröder, the ovaries were available for study in 31. In none of these did he find microscopic evidence of corpus luteum formation. Microscopically, the absence of active mature corpora lutea was confirmed. In one case an old retrogressive corpus luteum was found, and in another a corpus in the stage of proliferation. Schröder found multiple cysts in the ovaries which he described as unruptured follicles. These cysts were lined by 3 or 4 layers of intact granulosa and were surrounded by a delicate fibrous layer. Meyer's histologic findings correspond in general to those of Schröder. Schröder believes that the

persistent unruptured follicles produce a prolonged proliferative stage in the endometrium, and that the secretory phase of the endometrium fails to occur because of failure of follicular rupture and corpus luteum formation. Meyer believes that failure of the ova to mature and their death result in failure of follicular rupture and corpus luteum formation. Both Schröder and Meyer agree that the absence of the corpus luteum is uniform and essential to the formation of endometrial hyperplasia.

The material of Novak and Martzloff is admittedly somewhat incomplete, since they had only 22 uteri at their disposal, and in most instances only one ovary was removed. However, in 4 cases where definite hyperplasia was present they found active-looking corpora lutea in the ovary. Thus their findings differ slightly from those of Schröder and Meyer, but to our mind they are not completely incompatible. From clinical histories and histologic study of repeated endometrial biopsies it is apparent that endometrial hyperplasia is frequently a self-limited disease, and that reversion to the normal endometrial cycle often occurs spontaneously. The finding of an occasional corpus luteum associated with a hyperplastic endometrium might mean that the specimen was obtained at the transition period, when the reversion to the normal cycle had just taken place in the ovary but the endometrial pattern had not yet followed.

From the above histologic data it may be deduced that the one fact concerning the etiology of hyperplasia, of which we have demonstrable proof, is an absence of corpus luteum and its secretion, progesterone.

## RELATION OF ENDOMETRIAL HYPERPLASIA TO ENDOMETRIAL CANCER

The question of the relation of hyperplasia to the subsequent development of endometrial cancer is of the utmost practical importance. It is generally agreed that the usual Swiss-cheese type of hyperplasia, occurring during a woman's menstrual life, has no relation to carcinoma. The fact that thousands of premenopausal women are curetted for hyperplasia and receive no other treatment and yet remain well affords strong evidence that the condition is not precancerous. In our

rather extensive experience with this type of hyperplasia, we cannot recall a single woman who has returned subsequently with endometrial carcinoma.

In spite of the previous dogmatic statement, there are not uncommonly endometrial patterns in which the differentiation between endometrial hyperplasia and carcinoma is difficult. There are hyperplasias occurring in the years of the menopause and beyond, suggestive of estrogen stimulation beyond that to be expected in this age group. The relation of these hyperplasias to endometrial carcinoma has been the cause of study and speculation by many. In 1932 Howard Taylor first called attention to the possible relationship and concluded from a histologic and clinical study that the differentiation could be difficult and that mistakes could be disastrous. In 1947 Gusberg called attention to a pattern of adenomatous hyperplasia which he believed bore a constant relation to estrogen stimulation in both benign and malignant tissue. He also believed he could observe a graded progression from adenomatous hyperplasia to malignancy.

In 1949 Hertig, Sommers and Bengloff made an extensive study on the genesis of endometrial cancer. They defined "adenomatous hyperplasia" as hyperplasia with outpouching of the budlike, glandular projections into the supporting endometrial stroma. This was the most common lesion found in the group in which the endometrium was available for examination from 1 to 13 years before the diagnosis of cancer was made. They concluded that "adenomatous hyperplasia" may regress, although in many instances it was found to be a precursor of endometrial cancer. In 1952 Speert published an excellent paper on "The Premalignant Phase of Endometrial Cancer" among 13 cases in which curettings obtained from 1 to 20 years before were available for study. In only 2 instances were the curettings normal. In the remaining 11 hyperplastic gland patterns were found with infolding papillary projections and/or outpouching of epithelium, crowding of the glands and alteration in staining properties. Speert regarded these hyperplasias as distinct from ordinary functional hyperplasia, with which viewpoint we heartily agree.

In 1953 Te Linde, Jones and Galvin made

a retrospective study on a group of their cases of endometrial cancer in which previous curettings were available for study. Their material was divided into 3 groups:

Group I was composed of 13 cases in which curettage was done and the interpretations of the curettings were controversial. Because the surgeons in charge believed the curettings to be too suspicious to justify waiting, immediate hysterectomy was done.

Group II was composed of 14 cases in which curettage was done and the interpretations of the curettings were controversial. Definitive treatment was not carried out immediately. Because of recurrent bleeding, curettage was done from 10 months to 23 years later and frank adenocarcinoma was found.

Group III represented a retrospective study of 8 cases of adenocarcinoma of the endometrium in which previous curettings obtained from 3 to 34 years before were available for study.

In making a study of this kind several difficulties were encountered. In recent years it has been our custom to give intracavitary radium 6 weeks before hysterectomy. Hence, in those cases in which the clinician believed that he had sufficient histologic evidence to warrant a diagnosis of cancer, radium was applied. This often ruined the endometrium for subsequent histologic study. Therefore, many of the cases for this study have been taken from the remote past so that the unirradiated uterus could be studied.

Another difficulty in interpreting the sections histologically arose from the fact that with endometrial adenocarcinoma cytologic changes indicative of malignancy are often not marked, even when the general histologic picture indicates undoubted cancer and even invasion.

A third difficulty arose in evaluating invasion. Even when the myometrium is well invaded, the character of the invading cells is altered so little that it may be difficult to distinguish between adenomyosis and invading adenocarcinoma.

Nevertheless, we attempted to evaluate the cases by thorough histologic examination of the curettings and the endometrium of the subsequently removed uterus.

From our first group of 13 cases which were operated on promptly after the curet-



FIG. 268. (Top) Hyperplastic pattern of endometrium of postmenopausal woman, classified as "atypical," "adenomatous" or "proliferative." Note the high active-looking epithelium lining the glands. (Bottom) Endometrium of same patient a few months later, showing endometrial cancer.

tag and in which the diagnoses of "atypical hyperplasia," "adenomatous hyperplasia" and "proliferative hyperplasia" had been made, there is a strong suggestion that the endometrium obtained by curettage was in fact carcinoma. Figure 268 illustrates such a case. This opinion is based upon the frequent finding of these lesions in the same endometrium with advanced carcinoma and the histologic transition of these lesions to the more malignant-appearing ones.

Our data in Group II in which there was a lapse of months or years between the curettage and hysterectomy suggest that often



FIG. 269. Carcinoma arising in secretory endometrium, demonstrating that carcinoma of endometrium is not necessarily preceded by atypical hyperplasia.

endometrial carcinoma may be preceded by "hyperplastic" lesions for several years. Figure 268 represents such a case.

In our smaller Group III it was demonstrated that endometrial carcinoma may be preceded by secretory, nonsecretory, or ordinary glandular cystic hyperplasia up to within 3 years of the development of frank cancer. Adenocarcinoma can arise within secretory endometrium as shown by Jones and Brewer and illustrated in one of our cases (Fig. 269).

#### TREATMENT OF FUNCTIONAL BLEEDING

In considering the treatment of functional bleeding one always should bear in mind that the condition is one in which spontaneous remissions are frequent. It is well to keep this foremost in one's mind for two reasons: (1) as encouragement to the physician and the patient in those cases that resist conservative therapeutic measures; (2) for evaluating therapeutic measures. Often much credit has been given to different forms of therapy when the remissions were obviously spontaneous.

All cases of functional bleeding require a diagnostic curettage for study of the endometrium. For the group in the years when cancer is more prevalent this is particularly important and never should be neglected; in



the 'teens curettage may be deferred at times until therapy has been given a trial. In performing this curettage, it is our belief that it should be done under general anesthesia rather than with the suction curette on the unanesthetized patient. When the patient is anesthetized the curettage is apt to be done more thoroughly, and thoroughness is essential from the standpoint of ruling out malignancy and of obtaining the greatest therapeutic value from the procedure.

There is, perhaps, some tendency to deprecate curettage as a therapeutic measure; therefore, before considering endocrine and radical therapy we should evaluate this simple surgical procedure. In the group of functional bleeders showing endometrial hyperplasia, figures are available to aid us. Mack found 83 per cent of the curetted cases well or improved; there was troublesome recurrence in only 17 per cent. In the cases under 35, however, only 39 per cent were improved or well. Our own results with curettage have been reported by Jones and Te Linde. Of 63 cases under 35 years the results were satisfactory in 25 after a single curettage; the results were satisfactory in 24 after multiple curettements; and in 14, more radical procedures were necessary. In 48 cases over 35 years of age, a single curettement gave satisfactory results in 22; in 3 more the results were satisfactory after multiple curettements; and in 23, radical procedures were necessary. From these figures we may deduce that curettage is worthy of a therapeutic trial. We have no available figures on the results of curettage in those cases of functional bleeding in which the endometrium is not of the hyperplastic pattern, but it is our impression that the results are somewhat better than with hyperplasia. It is apparent from the figures of Jones and Te Linde that multiple curettements were used much more often in the younger group than in the group over 35. This is true, for it has been our practice to yield to surgery or irradiation much more readily in the older group.

In a disease that is obviously the result of an endocrine disorder it is natural that attempts should be made to correct the disorder by means of endocrine substitutional therapy. In the early days whole ovarian extracts and corpus luteum extracts were used.

It is now known that these extracts were entirely inert. In spite of this fact some rather satisfactory results were reported in the literature. This can mean only that the disease is often subject to spontaneous remissions and even, at times, is self-limited, so that no matter what therapy one uses there always will be a certain percentage of patients who get well. Next, the luteinizing hormone from pregnancy urine was used in an attempt to stimulate luteinization in the human ovary and thus supply the deficient progesterone. Early results were rather favorable, although our own results with this never were very satisfactory. Frequently, bleeding stopped but often recurred, and retreatment with the luteinizing hormone was unsuccessful in checking the bleeding. Finally, no one has been able to show any definite evidence of luteinization histologically in the human ovary as a result of this pregnancy urine extract. It is our present opinion that the luteinizing hormone has no value in treating functional bleeding due to hyperplasia; there is not even a theoretical indication for its use in those cases in which the endometrium goes through a regular cycle.

The hormonal treatment as carried out in our clinic is outlined by Dr. Georgeanna Jones as follows:

Anovulatory functional (dysfunctional) uterine bleeding, associated with an estrogenic or hyperplastic endometrial pattern, can often be successfully controlled by progesterone substitution therapy while efforts are being made to establish an etiologic diagnosis (Fig. 270). The synthesis of many new, effective progestational compounds has made a number of satisfactory therapeutic regimens available, but certain facts must be understood in order to obtain successful clinical results.

Progesterone is not a hemostatic agent and exerts its action only on withdrawal, thus producing a chemical type of curettage. Therefore, if the patient is bleeding at the time therapy is instituted, bleeding will not be controlled until 6 to 8 days after cessation of therapy. Consequently, appropriate steps must be taken to cover this lag period: bed rest, if symptoms are severe enough to warrant it, iron therapy and reassurance. If the patient is not bleeding at the initiation of treatment, a menstrual period can be expected within 2 to 4 days after cessation of progesterone therapy.



FIG. 270. (A) Endometrial hyperplasia before treatment. (B) Same endometrium changed to secretory type following progesterone therapy.

The basic method of treatment is a single injection of 25 mg. of progesterone in oil (water suspensions are irritating and cause severe local reactions) given once every 28 days for 3 cycles as suggested by Holmstrom. 17-Hydroxy-progesterone-caproate (125 mg., Delalutin, Squibb) can be substituted for progesterone, but in our experience it offers no advantages. If the patient is bleeding at the initiation of treatment, it is wise to cover the initial injection with additional oral therapy over a 3-day period; 25 or 30 mg. daily of ethisterone is adequate for this purpose. Ethisterone can also be used without intramuscular progesterone, and this method has the advantage of reducing the number of office visits necessary. A 5-day course of 25 or 30 mg. of ethisterone daily, repeated every 28 days for 3 cycles, is given. Approximately 2 per cent of patients with anovulatory bleeding show an atrophic endometrial pattern. In this group of patients, it will be necessary to give adjunctive estrogen: 1 mg. of stilbestrol or its equivalent, during the 3 weeks prior to progestational therapy.

The 19-nortestosterone derivatives are potent progestational agents and are reported to be hemostatic in action. These substances two of the most popular are norethynodrel (Enovid) and norethindrone (Norlutin) are also most effective as pituitary gonadotrophin suppressors. They are synthetic compounds and have diversified hormonal activities, showing both progestational and androgenic action. Norethynodrel is also estrogenic, and the commercial preparation (Enovid) has additional estrogen supplied. Southam reports that the 19-nortestosterone compounds will arrest bleeding within 24 hours, if given in amounts of between 10 and 30 mg. daily. This dosage can be continued for 3 weeks and then discontinued, allowing the patient to menstruate. Although expedient, the inherent danger in the use of these drugs is that real pathology may be obscured, as it is reported that bleeding due to thrombocytopenia, endometrial polyps, fibroids and conceivably carcinoma of the endometrium, can be controlled equally as well as functional bleeding. However, 19-nortestosterone can also be used as progestational substitution therapy, in which case only 2.5 mg. daily during a 5-day period is adequate to relieve symptoms.

It should be emphasized again that progestational therapy is substitutional and rarely if ever initiates ovulation. Functional bleeding is subject to spontaneous remissions; thus 40 per cent of the patients will not require further treatment after an initial 3-month therapy

period. While the symptoms are being controlled hormonally, diagnostic proceeding should be undertaken to clarify the underlying etiologic factor and institute specific therapy as indicated. The causes of anovulatory functional bleeding, aside from the physiologic factors involved at puberty and the menopause, are (1) nutritional inadequacy, (2) metabolic and chronic diseases, (3) emotional disturbances or (4) polycystic ovaries (Stein-Leventhal syndrome). The last should be suspected especially when severe, persistent bleeding occurs in young women in whom no metabolic disease or emotional factor can be demonstrated. Under these circumstances, a culdoscopy examination is indicated. Specific therapy represents improved eating habits, with extra calories and vitamins when malnutrition exists; thyroid in adequate dosage over a prolonged interval when real laboratory evidence of hypothyroidism can be demonstrated; and propylthiouracil or surgery if hyperthyroidism is present; good diabetic regulation for the diabetic patient; reassurance and mild sedation for the emotionally disturbed patient with psychiatric care when indicated. If polycystic ovaries are found, a Wedge resection operation must be performed.

What of the patients who fail to respond to curettage or endocrine therapy? Radical therapy should be withheld in proportion to the youth of the patient and in proportion to her desire for children. When the patient is past 40, recurrent functional bleeding may be treated quite satisfactorily by intra-uterine irradiation or by x-rays. From 1,500 to 2,000 mg. hrs. of intracavitary irradiation is the usual dosage. If the uterus is large, thus increasing the distance from the ovaries, we are inclined toward the larger dosage. We have found no evidence that such irradiation per se has increased the incidence of endometrial cancer. Sheffey's follow-up of a series of such cases confirms our opinion.

It is our custom to explain to such patients that an artificial menopause will result, the symptoms of which may vary greatly in intensity. Since the natural menopause is probably only a short time in the future, most of such patients will choose irradiation rather than surgery. If the patient is prejudiced against irradiation, we perform vaginal hysterectomy. If other conditions are present that should be corrected surgically, such as relaxed vaginal outlet, rectocele, cystocele or descensus, we urge surgery over irradiation.

For patients in the thirties, we perform hysterectomy with conservation of ovarian tissue. Occasionally, in this age group, when recurring bleeding is marked and the patient is extremely eager for future children, we have used small doses of irradiation with the hope of temporary amenorrhea and a return of normal menstruation. In some instances our hopes have been justified.

Below the age of 30, resort to radical treatment is to be strongly avoided. If endo-

crine therapy fails, one almost always can control the hemorrhage temporarily by repeated curettage, and in the more severe cases transfusion may be used. In most instances persistence in these conservative measures is rewarded eventually with remission of the bleeding and often a return to a normal menstrual cycle. We have observed many pregnancies in women who for years had been subject to functional bleeding which was treated with conservatism and patience.

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# Endometriosis

Endometriosis was described by Sampson as the "presence of ectopic tissue which possesses the histological structure and function of the uterine mucosa. It also includes the abnormal conditions which may result not only from the invasion of organs and other structures by this tissue, but also from its relation to menstruation."

It is an extremely fascinating condition, for nowhere else in human pathology does benign tissue possess the ability to invade adjacent tissue. The solution of its etiology and treatment offers a stimulating challenge to gynecologists, and more particularly to American gynecologists because most of the progress that has been made in the study of this disease is the result of American investigation.

In discussing endometriosis both pathologically and clinically it is desirable to divide it into two types: (1) the internal, which involves the uterine muscle from within; and (2) the external, which involves tissues outside of the uterus and the serous surface of the uterus from without.

## INTERNAL ENDOMETRIOSIS

Glandular elements were described in myomata in many instances during the last half of the past century. According to Breus, a total of 100 cases had been collected up to 1884, although not until the monograph of von Recklinghausen, published in 1896, was the condition firmly established as a pathologic entity. In 1897 Cullen described his first case of "adenomyoma" of the uterus. In 1908 he published his monograph on the subject, reporting 92 cases of adenomyoma, beautifully illustrated by Herman Becker and August Horn. Cullen used the term "diffuse adenomyoma of the uterus" to describe those cases where there was a generalized invasion

of the uterine musculature; more recently the term "adenomyosis" has been used widely and probably is more accurately descriptive. Four types of internal endometriosis are encountered:

1. *Diffuse adenomyosis*, involving either the anterior or the posterior wall of the uterus or both. The uterus usually shows slight symmetric enlargement. The deep-lying islands of endometrium, or perhaps the blood arising from them, seem to have a stimulating effect upon the musculature, which grows in irregular whorls. This increase in the musculature, as well as the endometrial growth, results in thickening of the uterine wall (Fig. 271).

2. *Localized nonencapsulated areas of adenomyosis* which histologically show the same picture as the diffuse type but are limited in the extent of their growth.

3. *Submucous growths* which project into the uterine cavity (Fig. 272).

4. *Circumscribed adenomyomas* which are encapsulated like ordinary intramural myomas but differ from them in that they contain endometrial glandular tissue (Fig. 272).

Considered from a pathologic point of view, internal endometriosis is a rather common disease. In the 15-year period from 1933 through 1947 internal endometriosis in one of the forms described above was encountered 530 times in The Johns Hopkins Hospital Gynecological Pathology Laboratory. In many instances the glandular invasion of the uterine musculature was slight and was discovered only on histologic examination. In a large proportion of these cases the condition was of no clinical significance. It is interesting that in approximately 12 per cent of these cases that were examined the external form of the disease was also present.

The origin of the glandular tissue in these uterine growths was the subject of controversy between Cullen and von Recklinghausen. Cullen maintained that the glands were of müllerian origin, whereas von Recklinghausen believed that they developed from remains of the wolffian tubules. Von Recklinghausen observed that the growths containing glandular tissue were frequently found in the posterior wall of the uterus and near the isthmic portion of the fallopian tubes. Since these areas are the same as those in which remains of the wolffian tubules are found most frequently, he reasoned that wolffian rests were the source of the glandular growths. Cullen quite conclusively showed in the majority of his cases that a direct continuity could be demonstrated between

the endometrium of the uterine cavity and the histologically similar tissue lying deep in the musculature. Experience with these growths since then has proved the correctness of Cullen's views. The reaction of the deep-lying glandular tissue to the ovarian hormones during the menstrual cycle and also during pregnancy has further established the müllerian identity of the tissue.

#### SYMPTOMS

Lesser degrees of invasion by the endometrium of the uterine musculature or myomata generally result in no symptoms, but when there is extensive adenomyosis there is usually increased menstrual flow and pain. Symptoms most often appear during the 4th and the 5th decades. The menorrhagia can

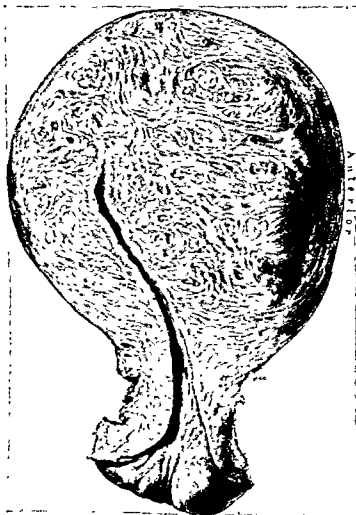


FIG. 271. Adenomyosis of uterus (after Cullen). A typical example with complete involvement of both anterior and posterior uterine walls. At the operating table such a uterus is moderately enlarged, usually symmetrically, and very firm to palpation.

be explained by the increased endometrial surface from which bleeding takes place. Although the drainage of the ramifications of the endometrial tissue into the uterine cavity is not perfect, often sufficient menstrual blood finds its way into the cavity to increase the flow materially. The pain, often severe and grinding or knifelike in nature, probably is due to muscular tension caused by bleeding in the deep-lying islands of endometrium. Figure 273 shows the pathologic basis for these symptoms.

#### PELVIC FINDINGS

There is, in most instances, a slight increase in size and firmness of the uterus, but seldom is the uterus more than twice its normal size. With the diffuse form of adenomyosis involving one or both walls, the uterine enlargement is usually symmetric. With a localized area of adenomyosis or with a true circumscribed adenomyoma, the enlargement may be asymmetric.

#### DIFFERENTIAL DIAGNOSIS

Adenomyosis always should be suspected when there is a history of severe menstrual pain acquired in the 4th or the 5th decade. When the pain is associated with increased flow, the history becomes more suggestive. The finding of a uterus slightly and symmetrically enlarged confirms the suspicion, but rarely can one be certain of the diagnosis since a symmetric enlargement of the uterus may also be caused by the growth of an ordinary intramural fibroid. Since symmetry of enlargement is not the rule with fibroids, it speaks for adenomyosis. On the other hand, incidental fibroids may cause irregularities on the surface of a uterus that is the site of internal endometriosis.

#### TREATMENT

Although an exact differential diagnosis is frequently difficult, it may be largely of academic interest, for whether the above symptoms and findings are due to myomata or

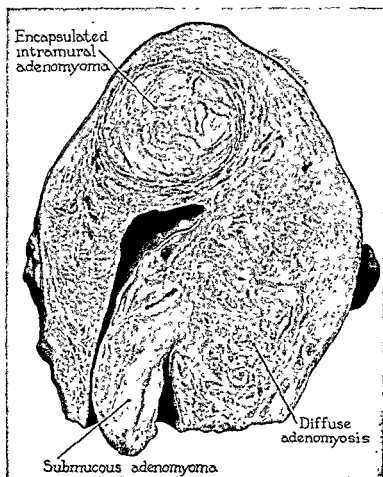


FIG. 272. Uterus showing 3 types of adenomyomatous growth: encapsulated intramural adenomyoma, submucous adenomyoma and diffuse adenomyosis of both uterine walls.

adenomyosis, a laparotomy is indicated. At the operating table the distinction usually can be made by palpation, if not by inspection. Generally, the outlines of the intramural fibroid can be palpated as a *circumscribed* firm area, whereas the diffuse adenomyosis is felt as a thickened, firm uterus due to thickening of the anterior or the posterior wall or both. Hysterectomy is the method of treatment of diffuse adenomyosis in almost all instances. Fortunately, most of the cases occur at a time in menstrual life when child-bearing is no longer of importance to the patient. The criteria for choosing between total and subtotal removal of the uterus are the same as those when hysterectomy is done

for fibroids. The indications for preservation or sacrificing of ovarian tissue are the same as when hysterectomy is done for fibroids. When the condition makes its clinical appearance shortly before the expected date of the menopause, in certain cases irradiation may be preferred to hysterectomy.

### EXTERNAL ENDOMETRIOSIS

External endometriosis, or ectopic endometrium growing elsewhere than in the uterine musculature from within, is of clinical importance much more frequently than the internal form of the disease. Actually, we have found the two conditions histologically in about an equal number of instances in our

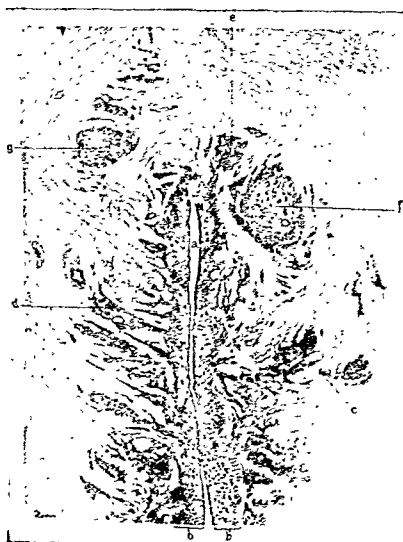


FIG. 273. Section through central portion of uterus with adenomyosis. (a) Uterine cavity. (b) The endometrium of the cavity. (c, d, e, f, g) Islands of displaced endometrium into which there is hemorrhage at the time of menstruation. The poor drainage of the menstrual blood with increased tension explains severe menstrual pain.



laboratory. In many instances the invasion of the myometrium from within was very slight and of no clinical significance, whereas in most of the cases of external endometriosis the ectopic endometrium was of clinical importance. Since 1897 when Pfannenstiel described the first case of adenomyoma of the rectovaginal septum the condition has been recorded with increasing frequency. Endometrium was first described in the ovary by Russell in 1899. In that same case a small endometrial nodule was present in the uterosacral ligament.

Gynecologists are recognizing external

endometriosis more frequently than formerly. This is partially due to better education in the field of gynecologic pathology, but there is a strong probability that the disease is actually on the increase. In the 15-year period prior to 1948, 8,789 pelvic laparotomies were done on the gynecologic service of The Johns Hopkins Hospital. In 5.6 per cent of these laparotomies external endometriosis was found. In considering the incidence year by year it is noteworthy that there was a steady increase in the incidence. For example, in 1933 endometriosis was present in 3.2 per cent of the abdomens opened,

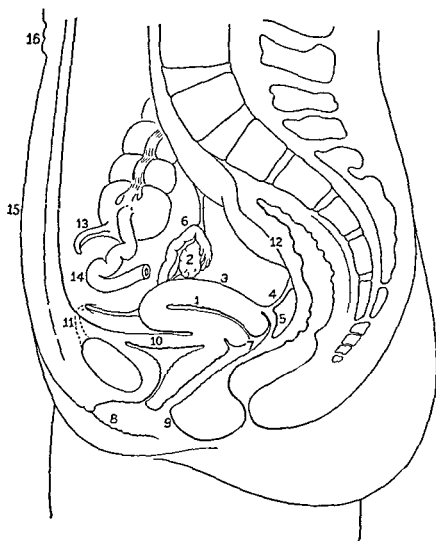


FIG. 274. Schematic drawing of sites of endometriosis. (1) Adenomyosis. (2) Ovary. (3) Serous surface of uterus. (4) Uterosacral ligament. (5) Cul-de-sac. (6) Tube. (7) Cervix. (8) Vulva. (9) Perineum. (10) Bladder. (11) Extraperitoneal portion of round ligament. (12) Rectosigmoid. (13) Appendix. (14) Ileum. (15) Abdominal scar. (16) Umbilicus.

whereas in 1947 the incidence had risen to 9 per cent. In our clinic we have been acutely aware of the condition since long before 1933, and all of the specimens have been subjected to microscopic analysis. It hardly seems possible that this could represent anything other than an absolute increase. The increase is due almost entirely to a greater incidence in the white private patients, in whom the incidence was 7.5 per cent in 1933 and 21.6 per cent in 1947. The significance of the high incidence in private patients will be considered later in this chapter under histogenesis.

#### DISTRIBUTION AND GROSS PATHOLOGY

Endometrial growths have been described in a great variety of places, chiefly within

the female pelvis; the organ most frequently involved is the ovary.

Figure 274 illustrates the distribution diagrammatically, and Table 8 shows the numerical incidence of the condition in the various pelvic structures.

In addition to these usual sites some very unusual and rare locations have been reported. Bungeler and Fleury-Silveira reported the presence of endometrial lesions in the pleural cavity; Navratil and Kramer described endometriosis in the extensor carpi radialis muscle of the forearm; and Mankin, in the left thigh. The nature of the more important lesions will be discussed below.

The lesions of the ovary vary in size from small ones of pinhead size to those larger than a child's head. The small superficial

TABLE 8. LOCATION OF EXTERNAL ENDOMETRIOSIS

TYPE	SITE	NUMBER	PER CENT
Superficial and small spots on serosa	Ovary—one	285	55.2
	Ovary—both	127	24.6
	Diffuse scattered pelvic	171	33.1
	Uterine surface	73	14.1
	Tubal surface	71	13.7
	Posterior cul-de-sac	24	4.7
	Uterosacral ligaments	19	3.7
	Anterior cul-de-sac	11	2.1
	Omentum	3	0.6
	Round ligaments	2	0.4
	Broad ligaments	1	0.2
	Small intestines	1	0.2
	Appendix	7	1.4
Intra-abdominal nodules	Rectovaginal septum	8	1.6
	Rectovaginal septum with recto-sigmoid involvement	20	3.9
	Rectovaginal septum with vaginal extension	9	1.8
	Sigmoidal	4	0.8
	Anterior cul-de-sac	2	0.4
	Anterior cul-de-sac with bladder involvement	5	1.0
	Tube	8	1.6
	Broad ligament	4	0.8
	Round ligament	3	0.6
Extra-peritoneal	Cervix	13	2.5
	Inguinal	4	0.8
	Umbilical	4	0.8
	Incisional-ventral	4	0.8
	Incisional-vulval	1	0.2

Total amounts to over 100 per cent because of multiple lesions.

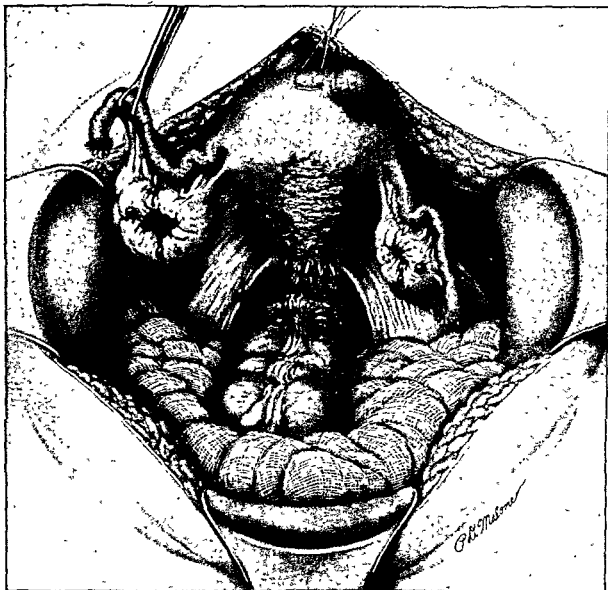


FIG. 275. Typical picture of pelvic endometriosis. Both ovaries, the uterosacral ligament, the posterior surface of the uterus and the rectal wall are involved.

lesions are more frequent on the convex ovarian surface and vary in color from dusky red to brownish black, depending on the state of preservation of the contained blood (Fig. 275). The larger cysts are often rather thick-walled and dull white in color, or in the thinner areas the dark chocolate-colored contents may darken the wall to brown or almost black (Fig. 276). The cysts, large and small, characteristically perforate when the pressure from intracystic hemorrhage becomes sufficiently great. The organization of the extruded blood seals over the defect in the cyst wall, and blood accumulates anew within

the cavity until perforation again takes place. This discharge of blood with organization results in adhesions about the ovary and elsewhere in the pelvis. The peritoneum, irritated by this blood, becomes hyperemic and thickened. Upon opening the peritoneal cavity the characteristic picture is a variable amount of old blood, free in the cavity. Usually, this is very scanty, but in rare instances, where large cysts have ruptured, as much as 100 or 200 cc. may be present. When the cyst is dissected free, the point or points of previous perforations are inevitably broken into, and there is spilling of the cyst contents. Gen-

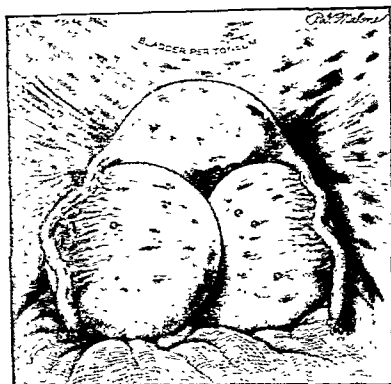


FIG. 276. Typical bilateral endometrial cysts of ovary. Old blood is disseminated on the pelvic peritoneum.



FIG. 277. Pelvic endometriosis with corpus luteum hematoma. A typical picture often seen at operation. The cul-de-sac is obliterated by dense adhesions. There is a large endometrial implant on the posterior surface of the uterus and the anterior surface of the rectum. The ovary contains a ruptured corpus luteum hematoma.

erally, the contents are a thick brown fluid from which the name of chocolate cyst has been derived; sometimes the contents are very thick, tenacious and almost black in color. The Germans have called these tar cysts and, indeed, the contents may resemble tar more than chocolate. The presumptive evidence is in favor of an endometrial cyst when on dissecting free an adherent ovary or ovarian cyst chocolate or tarry substance appears. This is not an invariable rule, since hemorrhage into corpora lutea and also into other types of ovarian cysts may give a similar picture (Fig. 277). However, the blood in a corpus luteum hematoma is much more apt to form a clot rather than remain a thick fluid as in an endometrial cyst. Hemorrhage into a serous cystadenoma may give a chocolate color to the contents; but the blood, being mixed with the serous contents, is not

usually sufficient to alter the consistency of the fluid.

Next to the ovary the uterus is involved most frequently. The serous surface of this organ is often the site of many implants. They are usually very small, although occasionally they form dark vesicles as large as peas (Fig. 277). Wherever the endometrial lesion occurs on serosal surfaces there is apt to be a characteristic puckering of the serosa about the small dark lesion. Implants on the anterior surface of the uterus sometimes cause adhesions between it and the peritoneal surface of the bladder. Invasion of the bladder may extend through the entire thickness of the organ (Fig. 278). The lesions are more common on the posterior surface of the uterus and especially common on the lower portion. The cul-de-sac is a favorite place for endometrial "implants"; the posterior

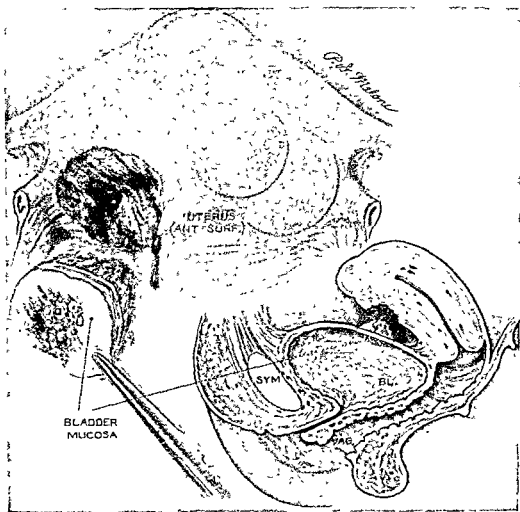


FIG 278. Endometriosis, involving the bladder wall.

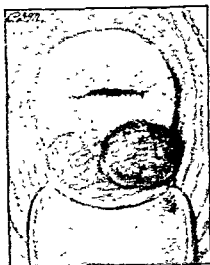


FIG. 279. Endometrial polyp growing in posterior vaginal fornix from cul-de-sac endometriosis.

wall of the vagina and the cervix often become densely adherent to the anterior rectal wall, thus completely obliterating the cul-de-sac. The uterosacral ligaments on either side of the cul-de-sac are commonly involved in the endometrial growth and form small, puckered, shotty nodules along the course of the ligaments. An extension downward of the invasive endometrial process from the cul-de-sac and the uterosacral region brings it down into the rectovaginal septum, involving the anterior rectal wall and at times penetrating the mucosa of the posterior vaginal vault. This growth may be visible through a vaginal speculum as a dark nodular mass posterior to the cervix (Fig. 279).

Small endometrial implants may occur on the serosa of the round ligaments at any place within the peritoneal cavity, but a lesion of special interest is that described by Cullen in 1896, in which the extraperitoneal portion of the round ligament is involved in an adenomyosis process, forming a nodule in the region of the inguinal ring. Such a nodule may be from 1 to 3 cm. in diameter and is usually blended diffusely with the surrounding adipose tissue. The round-ligament growths are composed of smooth muscle with islands of endometrium and dark areas that give evidence of hemorrhage.



FIG. 280. Endometriosis of the umbilicus,

Many cases have been reported in the literature of endometriosis of the umbilicus. Here the endometrial tissue infiltrates the surrounding tissues and by hemorrhage forms bluish nodules, sometimes visible through the skin (Fig. 280).

Laparotomy scars from operations on the uterus and the tubes occasionally are the site of endometrial growths. These growths appear as deep-lying nodules infiltrating the fat, the fascia and the muscle of the abdominal wall. Hemorrhage into the tissues at the time of menstruation causes discoloration of the tissues but frequently lies too deep for one to detect color changes through the skin.

In addition to involvement of the anterior rectal wall with invasion of the rectovaginal septum, a prominent lesion in the upper rectum or the sigmoid is not uncommon. Such a lesion causes thickening and proliferation of the smooth muscle of the bowel wall, and a true adenomyosis results. It may attain such a size as to encroach on the bowel lumen and be responsible for partial and even complete obstruction (Fig. 291). Bleeding into the lumen of the bowel is the rule when

the full thickness of the intestinal wall is invaded. At the operating table it may be with difficulty that such a lesion is differentiated from carcinoma if a previous biopsy through a proctoscope has not been performed. The presence of endometriosis elsewhere in the pelvis generally gives the clue to the nature of the bowel lesion.

The appendix and the terminal portion of the ileum are not infrequently involved in a process of endometriosis, but rarely to such a gross degree as is seen in the sigmoid and the rectum. The serosa of the ileum and the appendix becomes hyperemic, edematous, thickened and puckered around pinhead-sized dark lesions. Microscopic section of the appendix is often necessary to prove the presence of the suspected endometriosis. Figure 281 illustrates an extensive growth of endometrium on an appendix.

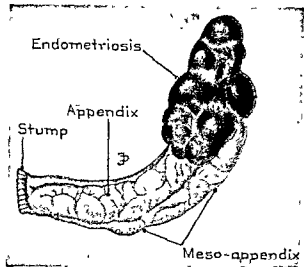


FIG. 281. Extensive endometriosis of the appendix.

### HISTOLOGY

Endometriosis in its various sites may present a variety of histologic pictures. In many instances, especially when located in the ovary, there are typical uterine glands and an abundance of typical endometrial stroma (Fig. 282). In the large chocolate cysts the epithelium lining the cavity is thinned out by pressure, sometimes to the point of being unrecognizable; indeed, in some areas the epithelium may be entirely lacking. Stroma, also, may be very scanty in some of the lesions, and one may be forced to search diligently for sufficient stroma to identify the tissue.

When the endometrium grows in a setting of smooth muscle as in the round or the uterosacral ligament, or on the surface of the uterus, it often seems to stimulate the proliferation of the smooth muscle which grows in whorls between the bits of endometrial tissue; thus histologically the growth may resemble internal adenomyosis.

In many instances the glands and the stroma go through the normal cyclic changes identical with those experienced by the endometrium in its normal site; during pregnancy a full decidual reaction is frequently noted (Fig. 283). However, the typical menstrual cyclic changes are not seen universally, and the endometrial pattern of the ectopic tissue may be purely proliferative, showing no pro-

gestational change; there are instances where the typical Swiss-cheese pattern of hyperplasia is present.

In some of the cysts the epithelial lining resembles tubal epithelium with ciliated and nonciliated cells. Sampson and Everett have described this, and the former has suggested the term *endosalpingiosis*. We have seen some cysts in which one part of the wall is lined by typical endometrium and another part by epithelium of the tubal type.

### HISTOGENESIS

In the early days of reporting cases of endometrial lesions outside of the uterus, Cullen and Russell stated that they believed the ectopic tissue, which was histologically similar to that found within the uterus, was müllerian in origin. Subsequent developments in our knowledge of the physiology and the histology of reproduction have shown beyond doubt that these lesions are of müllerian origin, since they show all variations of response to the ovarian hormones characteristic of endometrium in its normal site. These early writers believed that the ectopic endometrial tissue was the result of misplaced embryonic müllerian rests but made no attempt to explain the mechanism whereby the endometrial tissue was disseminated.

Not until Sampson's contributions, which first appeared in 1921, did gynecologists begin to bend seriously to the task of study-



FIG. 282. Multiple endometrial cysts of ovary. (A) Lower-power section of most of ovary. (A') Higher-power section of one cyst wall.



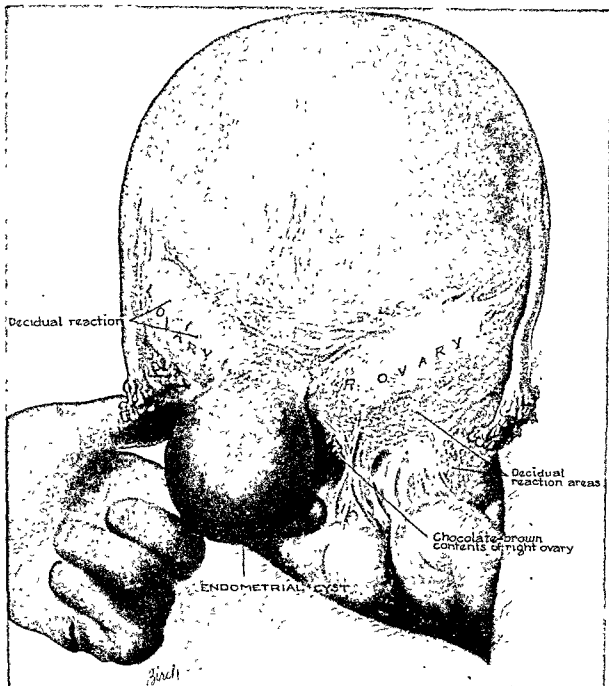


FIG. 283. Endometriosis associated with 36-weeks' pregnancy.

ing the histogenesis of this disease. At the outset, it should be stated that the problem has not been solved completely. Sampson's contributions have been many, and he has given consideration to many speculations regarding the histogenesis of endometriosis. However, the theory which is generally considered as his most important contribution

concerns itself with the question of whether or not the menstrual endometrium may flow in a retrograde manner out through the tubes, implant itself and proliferate on the pelvic viscera.

Sampson has briefly stated his implantation theory as follows:

Ovarian and other forms of peritoneal endo-



FIG. 284. Endometriosis involving intestines and lower abdomen of a monkey approximately 3 years of age following a hysterotomy to recover an early embryo.

metriosis arise from the implantation of bits of müllerian mucosa, of either uterine or tubal origin, which, having been carried with menstrual blood escaping through patent tubes into the peritoneal cavity, have lodged on the surfaces of the various pelvic structures. The ectopic mucosa in these implants, regardless of their size or situation, may become additional foci for the spread of the endometriosis by direct extension and also by the implantation of bits of müllerian tissue which escape from them during their reaction to menstruation. This latter phenomenon is most spectacular in the ovary where ectopic endometrial cavities may attain a much larger size than elsewhere, forming the well-known endometrial cysts of that organ.

Sampson originally believed that the ovary acted as an incubator or hotbed for the devel-

opment of implants on the peritoneum and might even impart greater virulence to the müllerian epithelium growing in it. He based this belief on the fact that in the cases studied by him up to 1922 the endometriosis was more extensive and more invasive in those cases that were associated with endometrial cysts of the ovary. However, the study of more material showed him that extensive pelvic endometriosis may occur without ovarian involvement; hence, he considers unwarranted his earlier suggestion that the ovary imparts greater virulence to the müllerian epithelium.

Sampson has deliberately operated on many patients at the time of menstruation and has frequently observed blood coming from the ends of the tubes. This observation has been substantiated by many gynecologists, and it is generally believed that retroversion of the uterus augments this flow. Sampson has fixed and sectioned this blood and has demonstrated it in uterine mucosa which he believes to be viable.

Sampson's theory is undoubtedly the most widely accepted one offered in explanation of the phenomenon of pelvic endometriosis. Anyone who has repeatedly observed at the operating table endometrial cysts of the ovary associated with pelvic adhesions that are obviously the result of organizing old blood can scarcely doubt that these adhesions form from blood spilled from these cysts. If one couples this observation with the fact that many of these adhesions, when sectioned, show endometrial tissue, it is difficult to escape the conclusion that the peritoneal endometrial plaques are implants from the bloody contents of cysts. The question of whether or not the endometrial-lined cysts of the ovaries are the result of implantation of bits of cast-off menstrual endometrium via the tube would seem to be the crux of the problem.

There is no doubt from experimental studies that endometrium cut from the uterine lining and transplanted into the pelvic cavity or other areas will grow. Haibitz, Allen, Weinstein *et al.*, Hobbs and Bortnick and numerous other workers have successfully transplanted surgically removed pieces of endometrium in lower animals. Markee transplanted endometrium into the anterior chamber of the monkey's eye where they

grew through many menstrual cycles. Heim, Caffein, Traut, Hirsch and Jones and others successfully cultured endometrium from surgically removed human uteri. The author repeatedly has seen endometriosis develop in the peritoneal cavity of rhesus monkeys following hysterotomy for recovery of fetuses (Fig. 284). Recently, Scott and Te Linde have transplanted bits of endometrial tissue removed by hysterotomy at various phases of the menstrual cycle and observed them by laparotomy to be growing up to 522 days.

Interesting as these observations are, until recently there were no unimpeachable experiments done to show whether or not the cast-off particles of menstrual endometrium are capable of implantation and growth. Therein lies the crux of the entire Sampson theory, for as Sampson himself has said:

If bits of müllerian mucosa carried by menstrual blood escaping into the peritoneal cavity are always dead, the implantation theory, as presented by me, also is dead and should be buried and forgotten. If some of these bits are even occasionally alive, the implantation theory also is alive.\*

Even the opponents of Sampson's theory have admitted that if it could be shown that cast-off menstrual endometrium is viable Sampson's hypothesis would be strengthened greatly.

Novak has summarized the objections that have been raised to Sampson's theory:

(1) Retrograde menstruation, while it may occur, is a rarely observed phenomenon, as contrasted with the great frequency of endometriosis; (2) it is difficult to believe that endometrium thrown off in the uterus could enter the small uterine orifice of the tube, travel outward against the current and still be capable of implanting itself and growing upon the pelvic structures; (3) endometrium thrown off at menstruation is already degenerated or dead, so that it is not easy to conceive of its taking root in the peritoneum; (4) such experiments as those of Jacobson, showing that endometrium can grow in the peritoneum, have dealt with the normal, healthy endometrium of animals; (5) experiments such as those of Heim in monkeys, in which a utero-abdominal fistula was created,

have all failed to show any development of endometrium in spite of the fact that the menstrual blood was emptied freely into the abdomen; (6) Sampson's theory could not explain endometriosis in certain locations, such as the umbilicus.\*

Most of those who have been skeptical of accepting Sampson's theory have championed the theory of Ivanoff and Meyer in one of its modifications. These two investigators independently advocated the idea that aberrant endometrium originates from abnormal differentiation of the celomic epithelium from which all the genital mucous membrane arises. This theory in its various modifications suggests that the pelvic peritoneum under certain stimuli, inflammatory or hormonal, may develop into endometrial-like tissue. We always have believed that the inflammatory stimulus to the pelvic peritoneum cannot be the answer, because in our colored wards where pelvic inflammation is commonest, endometriosis is rare. If the stimulus necessary to transform the pelvic peritoneum into endometrial tissue is hormonal, no one, as yet, has been able to explain just what abnormal hormonal stimulus is required to bring about the change. Meigs suggests that "menstruation during many years without interruption is the cause of endometriosis, and that it is due to the stimulation of the growth of the celomic epithelium and its embryonal rests." Meigs thus attempts to explain the greater incidence of endometriosis in the well-to-do patients, suggesting that later marriage in this group with no interruption to the menstrual cycle is responsible for the higher incidence of endometriosis. We cannot accept this explanation, because if the stimulus to the peritoneal epithelium necessary to the formation of endometriosis is hormonal, one would think that the overwhelming stimulus of pregnancy would favor rather than discourage the development of endometriosis. If late childbearing is a factor in the development of this disease, it would seem that the failure of cervical dilatation at childbirth might play a part in favoring retrograde menstrual flow, if one chooses to accept Sampson's theory.

\* Sampson, J. A.: The development of the implantation theory for the origin of peritoneal endometriosis, *Am. J. Obst. & Gynec.* 40:558.

\* Novak, E.: *Gynecological and Obstetrical Pathology*, Philadelphia, Saunders, 1940.

Halban's theory of dissemination of endometrium via the lymphatics is probably one of the least tenable of any of the theories. These endometrial lesions do not follow the

path of the lymphatics, and the finding of endometrial tissue in the pelvic lymph glands is very rare.

By 1950 the discussion had become static.

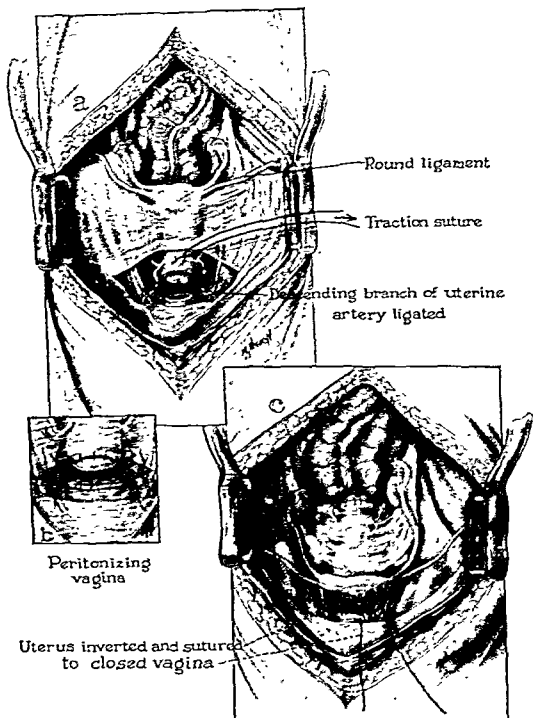
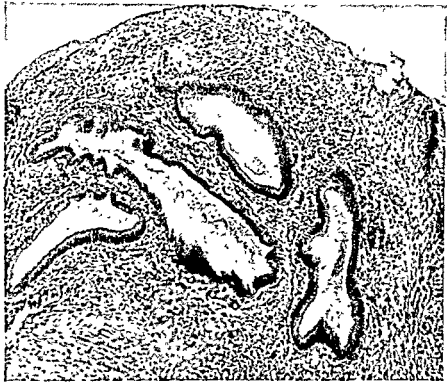


FIG. 285. The experimental surgical procedure on monkeys to allow intra-abdominal menstruation in which the entire uterus is separated from the vagina and turned through 180°.

FIG. 286. Endometrial glands and stroma grossly appearing as a purplish area on the right lateral pelvic wall 404 days after turning the uterus through 180°. This was one of several such areas at some distance from the reversed cervix ( $\times 100$ )



All of the arguments for and against the various theories had been advanced, leaving perhaps the most fundamental question concerning the viability of cast-off menstrual endometrium unanswered. Scott and Te Linde, working on the Carnegie Embryological In-

stitute, reported some experimental work which seems to have demonstrated the capability of growth in desquamated menstrual endometrium. Ten monkeys were treated surgically to permit them to menstruate into the abdominal cavity. The uteri were separated



FIG. 287. High-power study of an area in Figure 285 to show the characteristic epithelium and stroma. ( $\times 500$ )

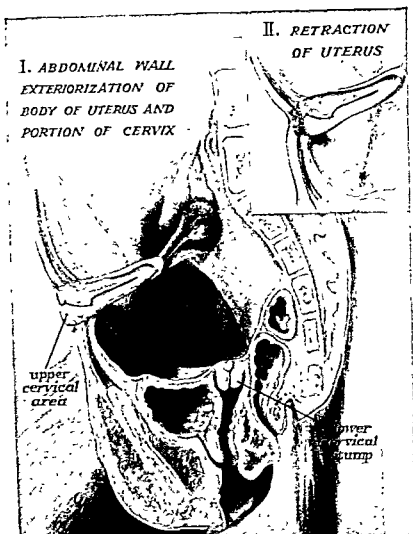


FIG. 288. The uterus, except for the distal portion of the cervix, was brought out through the anterior abdominal wall. The inset shows the retraction of the uterus and the scarring in the anterior abdominal wall.

from their vaginal attachments or amputated low on the cervix and turned either forward or backward so as to spill the menstrual discharge into the anterior or the posterior cul-de-sac (Fig. 285). Five of the monkeys developed extensive adhesions of the bowel to the turned cervix, and the intervening fibrous tissue revealed endometriosis (Figs. 286 and 287). One of the animals developed typical endometriosis on the bowel wall and peritoneum at some distance from the turned cervix. Five of the altered monkeys failed to develop endometriosis, but all of these developed numerous complications, either secondary to the type of operation or infections. The experiments were done with particular care to avoid instrumenting or in any way trauma-

tizing the intact endometrium. The cervix of the monkey comprises about two thirds of the length of the uterus. In those cases in which the cervix was cut preliminary to diverting the menstrual flow into the peritoneal cavity, the cutting was done just above the vagina, and in each instance a biopsy of the proximal portion was conclusive that endocervix and not endometrium was incised. In order to eliminate the possibility of heteroplasia of cervical mucosa or direct extension of endometrial tissue along the cervical canal and hence to the peritoneum, the portion of the cervix adjacent to the adherent bowel was freed and biopsied. In no instance was endometrium found in the cervix. Thus it would seem that the only conclusion that could be

FIG. 289. Endometrial glands and stroma in the scar tissue along the line of uterine retraction, 364 days after the surgical procedure in Figure 287. ( $\times 100$ )



reached from these experiments is that the desquamated endometrial tissue was viable and grew when transplanted. Growing endometrium was found from 75 to 963 days after the altering operations had been done. Still another monkey was made to menstruate via her cervix through a fistula in her abdominal wall (Fig. 288). A year later scar tissue along the abdominal sinus tract showed endometrial glands and stroma (Fig. 289). These experiments are believed to be strongly indicative of the fact that at least some portion of menstrual cast-off endometrium is viable. This fact would seem to strengthen greatly Sampson's theory of retrograde menstruation.

Finally, Ridley has reported some experiments in the human which confirm our work on monkeys and strengthens Sampson's theory. "Shed" or desquamated endometrium was collected at the cervix without entering the uterine cavity and implanted in the fat in the suprapubic region. The experiment has been done on 16 women, and in 2 unequivocal microscopic endometriosis was found 175 and 91 days after the implantation. In 4 others, scarring, pigmentation and cellular growth suggesting acini and stroma of endometriosis were found which Ridley did not consider completely acceptable for a diagnosis of endometriosis. However, the fact

that he was successful in some cases is sufficient to prove that some of the cast-off endometrium is capable of growth.

Our experiments on monkeys are supported by 4 accidental clinical experiments with which we are familiar. In 3 instances the cavity of a rudimentary horn of a double uterus failed to communicate with the cervical canal; therefore, the products of menstruation were forced into the tube and the peritoneal cavity. In all 3 instances endometriosis developed in the pelvis on the side of the rudimentary horn. Figure 290 shows the rudimentary horn with hematometra, hematosalpinx and an evacuated endometrial cyst. In the 4th case a maiden woman of 40 developed dysmenorrhea and eventually amenorrhea with recurring monthly pain. Examination showed complete obliteration of the upper vagina by adhesions. Laparotomy revealed endometriosis on the posterior surface of the uterus and in the cul-de-sac. These planned experiments in monkeys and accidental experiments in women would seem to give strong support to Sampson's theory.

Objections to acceptance of Sampson's theory as the usual histogenesis of most cases of endometriosis have been raised by Novak, Gardner, Greene and Ranney. One objection is that possibly the irritation of the menstrual

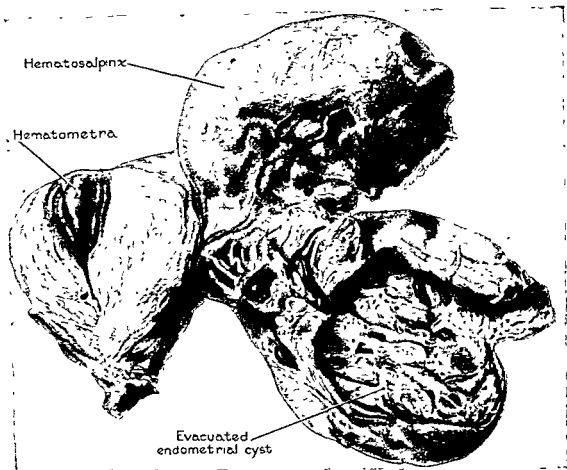


FIG. 290. Endometrial cyst occurring in a patient with a double uterus. The rudimentary horn did not communicate with the cervix; this resulted in hematometra, hematosalpinx and an endometrial cyst in the respective ovary. (Mayo Clinic)

blood into the peritoneal cavity stimulated metaplasia of the peritoneal serosal cells, changing them into typical endometrial tissue. The fact that endometriosis developed in the rectus muscle along the sinus tract of the monkey menstruating through the abdominal wall where no serosal epithelium exists would seem to nullify that argument. Also, a subsequent experiment was done by Scott and Wharton to determine whether the irritation of blood could cause metaplasia of the serosal epithelium. A venapuncture was done monthly on 2 monkeys, and 5 cc. of their blood was injected into the peritoneal cavity. After 2 years neither monkey has developed any endometriosis.

Gardner *et al.* also consider the possibility of direct growth of endometrium from the

uterine cavity of the displaced monkey's uteri to the peritoneum via the cervix. In several instances biopsies were taken from the cervixes of our monkeys, and in none was any endometrium found. The objection has also been raised by Gardner *et al.* that "no one had succeeded in growing desquamated human menstrual endometrium in vitro." However, Keetel and Stein have succeeded in doing this, their cultured cells being fibroblastic and epithelial in appearance. It is agreed by us that most of the tissue shed at menstruation is dead, but we believe that our experiments strongly suggest that some cells are capable of growth.

However, we agree with Gardner *et al.* that no single theory explains all cases of endometriosis. In fact, in our experiments



with monkeys we observed one case of endometriosis of the kidney which appears to us to have spread via periureteral lymphatics from a mass of pelvic endometriosis at the lower end of the ureter. We do not believe that there is much evidence that the lymphatics often serve as channels of dissemination of endometrium in the human. The remarkable cases of endometriosis of the forearm and the thigh reported in the literature would seem only to have resulted from dissemination via the blood stream.

### SYMPTOMS

Endometriosis is a disease of menstrual life. In a series of 516 cases of external endometriosis Scott and Te Linde found 65.5 per cent to occur between the ages of 20 and 40, but in many of these cases other lesions were present and, indeed, constituted the reason for the laparotomy. If the 243 cases in which the operation was done primarily for endometriosis are selected from this group, it is apparent that 81.6 per cent of the cases occur between 20 and 40. We have encountered a few cases in the teens, and occasionally endometriosis is discovered microscopically in pelvic organs removed for other causes after the menopause. In none of the postmenopausal women have we been convinced that the endometriosis was contributing to the symptoms.

*The most constant single symptom of endometriosis is pain.* In their entire group of 516 cases Scott and Te Linde found pain, exclusive of dysmenorrhea, to be present in 51.8 per cent of the cases, but if the group of 243 cases in which the operation was done primarily for endometriosis is considered separately, pain was found to be present in 57.7 per cent. In spite of the great frequency of pain we have repeatedly seen even advanced endometriosis in women without the slightest discomfort. Since the lesions are so varied in location it is natural that the pain arising from them should be varied in location and nature. In the most common type of endometriosis, with lesions scattered through the pelvis, lower abdominal pain is usually the presenting symptom.

The pain may be unilateral or bilateral; the rule is bilateral pain, more marked on one side or the other. It is apt to be aggravated



FIG. 291. Barium enema of patient with obstructive lesion due to endometriosis. This lesion was resected by a surgeon, who believed it to be carcinoma.

premenstrually or menstrually, leaving a residual pelvic soreness after the period. Nevertheless, in some instances acute attacks of pain may occur entirely unrelated to menstruation. Pelvic distress may vary from a moderate bearing down discomfort to severe boring or knifelike attacks.

*Dysmenorrhea* is a frequent symptom of endometriosis. There can be no doubt concerning this, and yet the textbook statement that the characteristic symptom is acquired dysmenorrhea is not exactly borne out by a careful analysis of the symptomatology. In analyzing 243 cases of endometriosis in which no other significant pathology was found, Scott and Te Linde found that 51.4 per cent had had dysmenorrhea since the onset of menses, and that there was no increase in the intensity of the menstrual pain. In 19.3 per cent there was a history of increasing dysmenorrhea, and in only 9.1 per cent was there actually acquired menstrual pain which coincided with the probable advent of the endometriosis. In almost 80 per cent, then, dysmenorrhea in some form was present, but it is noteworthy that the disease can be present even in extensive form without any menstrual pain.

Involvement of the uterosacral ligaments or an adherent retroverted uterus may be responsible for severe sacral backache. These same lesions may cause dyspareunia, which may be a prominent symptom.

When the rectal wall is involved, pain on defecation is common; often there is blood in the stool at the time of menstruation and also at other times due to ulceration. We have seen diarrhea occur as a result of involvement of rectal or sigmoidal mucosa, and we have also seen varying degrees of intestinal obstruction result from extensive sigmoidal or rectal involvement (Fig. 291).

When there is endometriosis in the abdominal scar, at the umbilicus, or in the inguinal region, there is usually a history of painful swelling at monthly intervals. Sometimes discoloration due to the hemorrhage is visible, and occasionally when the lesion is near the skin there may be external bleeding. Blood in the urine has been noted when the bladder wall is involved.

In spite of what has been said in the preceding paragraphs concerning pain, we would like to emphasize that many women with even extensive endometriosis have no discomfort at any time. Judging by the frequency with which one makes the diagnosis with reasonable certainty during routine pelvic examinations, it is probable that there are more women with endometriosis without pain than with it. The remarkable fact is that many women with extensive palpable endometriosis have no pain, whereas others with a minimum of palpable lesion have severe pain. Sturgis and Call have attempted to correlate the character of the peritoneal lesions with the degree of pain. They suggest that the lesions which are primarily on the surface of the peritoneum may expand outward in response to hormonal stimulation readily and cause no discomfort. The lesions beneath the serosal surface on the other hand, according to their belief, develop a fibrous tissue response and, thus encapsulated, distend with difficulty and with pain. Their theory is attractive, but the evidence which they present is not very convincing, and we are still completely in the dark on the reason for the discrepancy.

*Menometrorrhagia* is given by most textbooks as one of the more frequent symptoms of external endometriosis. In 26.6 per cent of Scott and Te Linde's cases in which the operation was done primarily for endometriosis abnormal bleeding was present. However, in this group there were several cases in which associated lesions were found that

obviously explained the bleeding so that the incidence of bleeding in the women with no other cause, but the endometriosis probably is not over 20 per cent. The menorrhagia, and perhaps in some instances the metrorrhagia, probably is the result of ovarian dysfunction. The intermenstrual spotting of old dark blood is due undoubtedly to the escape of the chocolate contents of the ovarian cysts into the abdomen and out through the uterus via the tubes.

*Sterility* is a common symptom. In the Hopkins series absolute sterility was present in 33.5 per cent, and relative sterility in 46.0 per cent. The normal absolute sterility rate is considered to be in the neighborhood of 10 per cent. There is then a high incidence of sterility in women with endometriosis. However, the above figures probably are higher than the incidence of sterility attributable to endometriosis because of the prevalence of contraception and the unknown factor of male sterility. The cause of sterility is obvious in some instances. Tubal occlusion, for example, accounts for some, but the incidence of sterility is considerably greater than the incidence of tubal occlusion in endometriosis. Periovarian adhesions, shutting off the ovum from the fimbriae of the tubes, also account for some cases, but there must be other less-well-understood factors. Perhaps the edema and the fibrosis of the tubes interfere with the normal peristaltic movement. Frequently, we have performed tubal insufflation prior to conservative surgery and found the tubes to be occluded, or we have got gas through at a high pressure. Insufflation several months after conservative surgery has resulted in gas going through the tubes at a much lower pressure. Perhaps also the chocolate material escaping from the abdomen through the tubal lumina interferes with the action of the cilia. Finally, the factor of dyspareunia and reduced sexual exposures may contribute.

In spite of the high incidence of sterility in endometriosis, *pregnancy does occur* in association with it. The fallacy of the statement in Goodall's recent book that pregnancy never occurs in association with endometriosis is established by many reports in the literature. Every obstetrician of wide experience has observed many cases of minor degrees of uterosacral endometriosis asso-

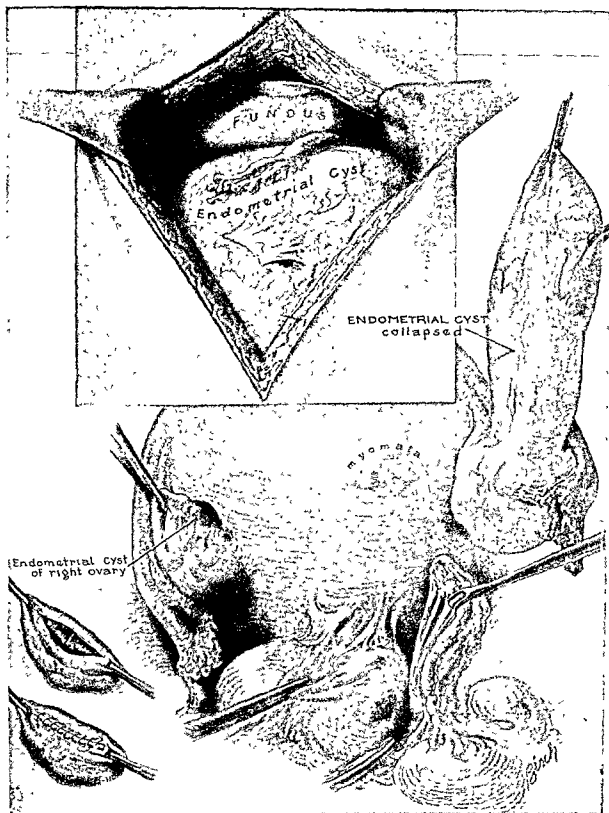


FIG. 292. Endometrial cyst of both ovaries associated with pregnancy of 12 weeks.

ciated with pregnancy. Recently, Scott has reviewed thoroughly the whole subject of ovarian endometriosis associated with pregnancy and has reported 2 cases. In the first

a cesarean section was done at 36 weeks because of rupture of one endometrial cyst (Fig. 283). In the second case operation was done because of pain at the 12th week of

pregnancy. In spite of the removal of one chocolate cyst of grapefruit size and resection of a smaller cyst from the other ovary, the patient went to term (Fig. 292). In addition to these 2 cases Scott collected 7 other cases of ovarian endometriosis clinically complicating pregnancy. Endometriosis of the rectovaginal septum in pregnancy was reported 11 times in the literature, and in addition there were 2 cases of anterior cul-de-sac involvement, 1 of an inguinal endometrial cyst, 2 of abdominal scar endometriosis and 1 of small intestinal endometriosis.

### DIAGNOSIS

The symptoms discussed above always should suggest endometriosis, but any or most of them may be present with other pelvic conditions. There is no history sufficiently typical of endometriosis to justify a diagnosis of endometriosis, and if one operates on the basis of history alone, without confirmatory pelvic findings, he will usually be disappointed and find grossly normal pelvic organs. In a disease with such a wide variation in distribution and character of the lesion it is not surprising that the symptoms and signs are quite variable. If a cystic, hemorrhagic lesion is visible at the umbilicus, in an abdominal scar, or in the posterior vaginal vault, the diagnosis of endometriosis can be made with relative certainty. In intraperitoneal pelvic lesions no such visible clue is at hand, and the suspected diagnosis must be confirmed by the bimanual examination. The finding of adherent adnexa in a woman in the menstrual years, in whom neisserian, postabortal or puerperal infection can be ruled out with reasonable certainty, should cause one to consider endometriosis. In such instances tuberculous salpingitis still remains a possibility that must be ruled out or established by history and other physical findings. *The presence of shotty induration in the cul-de-sac, in the uterosacral ligaments or on the posterior surface of an adherent retroposed uterus is probably the most suggestive single pelvic finding of endometriosis.* Marked tenderness of the nodular area in the cul-de-sac or the uterosacral ligaments is the rule. When these findings are coupled with an enlarged ovary or an adherent ovarian cyst, the diagnosis is almost a certainty.

When the rectovaginal septum is involved, the pelvic and the rectal findings may simulate malignancy of the bowel. Bluish cysts presenting in the posterior vaginal vault may be very helpful in deciding in favor of endometriosis. Endometriosis of the rectovaginal septum is usually of harder consistency than carcinoma. On being palpated rectally, the bowel mucosa may be entirely normal over the endometrial lesion that is invading from without. Even when the endometrial lesion has grown through the rectal mucosa, it is generally apparent to the palpating finger that the lesion has invaded from without. When the history suggests that the growth has appeared or grown postmenopausally, one can be quite certain that it is carcinoma rather than endometriosis. If there is any doubt after the usual rectovaginal examination, the patient may be proctoscoped and a biopsy made from within the bowel.

### TREATMENT

The treatment of external endometriosis is dependent on the severity of symptoms, the palpable extent of the disease process, the age and the general physical condition of the patient, the need and the desire for the preservation of the childbearing function and/or menstruation and the psychosomatic evaluation of the patient. In the absence of palpable pelvic disease, exploratory laparotomy on the basis of symptoms alone is rarely indicated. In such cases when the history is very suggestive but bimanual examination fails to disclose the characteristic signs, culdoscopy may prove to be of great value in making the final decision for or against laparotomy.

In considering the conservative treatment of endometriosis three courses are available:

1. *Simple Observation.* With the absence of significant symptoms this is certainly the treatment of choice. Occasionally, codeine or other mild analgesics may be used. If infertility is an important factor with the patient, active treatment is sometimes indicated.

2. *Hormonal Therapy.* It has been shown that suppression of ovulation, either by pregnancy or artificially, may cause an alleviation of symptoms and sometimes a palpable regression of the disease process. However, a recurrence of symptoms is frequent.

3. *Conservative Surgery.*

Hormonal therapy has been given a rather extensive trial. The first hormone to be tried was estrogen. The recommended dosage starts at 1 mg. per day and is worked up to 100 mg. per day. This treatment is carried on for a period of 3 months and then decreased by 6.25 mg. per day until the last dose is taken. As in the case with so many new therapies, time has shown that this treatment may leave much to be desired. Withdrawal bleeding has been troublesome and in a few instances has made emergency hysterectomy necessary. Also, the lack of permanent relief has been frequent, and it is our personal view that estrogen therapy for endometriosis is not worth the effort.

Androgens have also been tried extensively as a means of suppressing ovulation, but the frequent side-effects, such as hirsutism, voice change and acne, contraindicate its use in our opinion. These symptoms may occur with variable dosage; hence, it is difficult to determine the dosage which will be free from side-effects.

More recently, Kistner has used one of the newer progestins, inducing a state of pseudopregnancy, *norethynodrel* (Enovid). He has shown by endometrial biopsy and by examination of the ectopic endometrial tissue that a pseudodecidua is produced. Kistner recommends a dosage of 10 mg. daily for 2 weeks, starting on the 4th day of the menstrual period, then 20 mg. daily for 2 weeks, then 30 mg. for 2 weeks, and finally 40 mg. daily for as long as the therapy is advisable. Side-effects sometimes observed are nausea, breast soreness, increased appetite and gain in weight. A few patients have had bleeding, but Enovid contains a small amount of ethynylestradiol which tends to decrease the break through bleeding. While there is no doubt that the pseudopregnancy is attended by a diminution of symptoms, the ultimate permanent result is still doubtful, as is the result regarding future pregnancies. Hence, surgery still remains the *pièce de résistance* in the therapy of endometriosis.

In considering treatment of this disease one must bear in mind that the growth and the invasive properties of the endometrium depend on continued ovarian function. There is conclusive evidence that growth ceases and atrophy takes place after surgical or

irradiation castration. Nevertheless, there is sufficient evidence to indicate that conservation of the reproductive function is worth while in young patients. For example, in Scott and Te Linde's series there were 64 women in whom the reproductive function was preserved who were desirous of bearing more children. They were followed for from 9 months to 15 years; 26 of the 64 patients or 40.6 per cent conceived, and 31.3 per cent had term deliveries; however, 12.2 per cent of these women required further surgery or x-ray castration. Only a few of the subsequent operations were done in our clinic, and one wonders whether or not they were all necessary. The above-mentioned high percentage of pregnancies following conservative surgery is greater than that reported by most authors. Holmes found that pregnancy took place in 12 per cent on whom conservative surgery was done; Hurd reports 10 per cent, and Counsellor 13 per cent.

The above paragraph was written for the second edition of this book. We are glad to note in more recent publications that others have reported better results. For example, Gray reports 37.2 per cent of pregnancies after conservative surgery, and of 49 patients complaining of sterility 51 per cent became pregnant. Meigs also reports 32.4 per cent of pregnancies following conservative surgery. Most of the cases in our series were operated on for symptoms other than sterility, and the question arises whether surgery is indicated in endometriosis simply for the relief of sterility without other symptoms. We are inclined to believe that it is in selected cases with palpable disease.

Conservative surgery for endometriosis consists of removal of the whole involved ovary or resection of part of one or both ovaries, often suspension of the uterus, release of peritubal adhesions, fulguration of small implants, presacral neurectomy and other procedures in special forms of the disease. We resect ovaries more often for endometriosis than for any other condition. A preoperative Rubin's test gives the surgeon information which is valuable to him in making his decision at laparotomy as to exactly what structures to remove and particularly as to the disposition of the tubes. All

evident areas of endometriosis should be excised or destroyed by fulguration. Since in most cases the uterus is adherent in retroposition, freeing of adhesions and suspension usually should be done. In those cases in which the uterus is conserved it has been our custom in recent years to perform a presacral neurectomy. It is our impression that this is well worth while, but freedom from subsequent pain and dysmenorrhea is not always effected permanently. It should be recognized that in doing conservative surgery there is the possibility that more radical surgery may be necessary. In Scott and Te Linde's cases, as stated above, 12.2 per cent underwent more radical treatment later.

There is a group of women with external endometriosis in whom childbearing is no longer important but in whom it is most desirable to avoid an early menopause. These are chiefly women in their thirties and early forties. Hysterectomy with preservation of some ovarian tissue is good practice in this group. Scott and Te Linde were able to follow 98 women on whom such semiconservative surgery was practiced; they found that

only 4.1 per cent required subsequent radical treatment because of symptoms from persisting or recurrent endometriosis. There seems to be no doubt that the elimination of the menstruating uterus ensures relative comfort in the pelvis.

In women beyond the early forties, conservative surgical treatment is seldom advisable. Scott and Te Linde followed 112 women on whom radical surgery was done. The majority of these were past 40, but several were in the 4th decade and a few in the 3rd. As might be expected, no further surgery was required because of persistent or recurrent symptoms of endometriosis.

As may be judged from the preceding paragraphs, surgery in our hands is a flexible method of therapy in contrast with irradiation in which the destruction of ovarian function is essential for relief of the symptoms. In some instances also where there are mechanical distortions in the pelvis due to adhesions such as adherent retroposition, irradiation may not give complete relief even with castration. Therefore, we have reserved irradiation for carefully selected cases, espe-

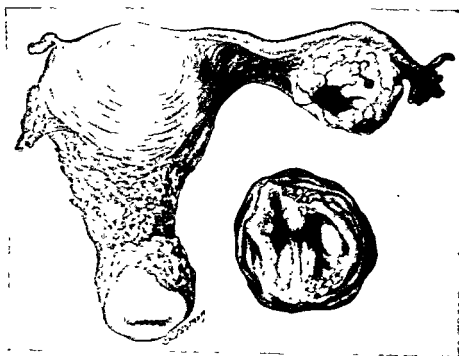


FIG. 293. Endometrioma which caused partial obstruction, resected from sigmoid. The ovary is also the site of endometriosis.

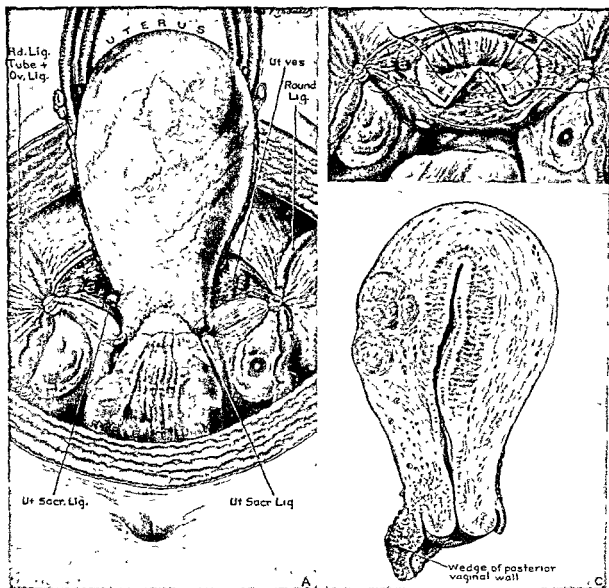


FIG. 294. Excision of endometrioma of rectovaginal septum with total hysterectomy. (A) Obliterated cul-de-sac, the result of the rectovaginal lesion. (B) A wedge-shaped section has been removed from the upper vagina. (C) Sagittal section of specimen, showing endometrial growth attached to vaginal wedge.

cially in middle-aged women with recurrence of symptoms following conservative or semi-conservative surgery. Enovid might also be given a trial in some of the recurrent cases.

Several special conditions encountered in this protean disease deserve special surgical consideration.

Not infrequently the pelvis is studded with many small superficial lesions on the peritoneal surface of the various organs and ligaments. When in young women conservation of ovarian tissue is practiced, the small

lesions may be destroyed with the high-frequency fulgurating current.

Occasionally, endometriosis is present on the posterior surface of the retroverted uterus with perfectly normal ovaries and tubes. When the age of the patient contraindicates hysterectomy, such a uterus should be freed, the implants fulgurated, and a uterine suspension done.

When advanced endometriosis results in a frozen pelvis involving the rectal wall and other pelvic structures, radical surgery with

excision of part of the bowel was practiced formerly. The mortality was high in this type of surgery, and rectovaginal fistula occasionally resulted. Simple supravaginal hysterectomy and double salpingo-oophorectomy is all that is necessary, for the withdrawal of the ovarian hormone will be followed by atrophy of the remaining endometriosis. If even this surgery is not feasible, or if even bilateral oophorectomy seems to be ill-advised, the abdomen may be closed, and the patient treated with irradiation.

An extensive lesion in the sigmoid causing obstruction may be difficult to distinguish from carcinoma even at operation. The presence of endometriosis elsewhere in the pelvis is helpful in making the diagnosis. Figure 293 shows the resected lesion and an endometrial cyst in the ovary. It is rare that the sigmoidal lesion is sufficiently obstructive to necessitate resection, and often partial obstruction can be treated satisfactorily by castration. Nevertheless, in young women resection or partial resection may be preferable to castration.

Endometrial lesions in the umbilical region, in abdominal scars and in the inguinal region are infiltrating lesions and should be excised with a wide margin, for a remnant may grow into a recurrent lesion of sufficient size to produce symptoms.

Usually, endometrial lesions involving the bladder wall invading from the peritoneal surface may be excised easily and safely during the course of the laparotomy when ovarian conservation is practiced (Fig. 278). If radical ovarian surgery is practiced, local excision is not necessary.

When the rectovaginal septum is involved, and oophorectomy is not desirable because of the youth of the patient, the endometrioma may be excised with the uterus, as shown in Figure 294. Endometrial polyps protruding in the posterior vaginal fornix may be controlled at times by fulguration until the patient attains such age that surgical or irradiation castration may be done with less serious results.

Finally, it should be stressed that surgery for endometriosis may be most difficult. The adhesions generally are extremely dense, much more so than the usual inflammatory or postoperative type. Sharp dissection is often necessary, especially in freeing the

uterus from the anterior rectal wall. Fortunately, the rectal wall is often thickened by fibrosis so that perforation of it is rare. Nevertheless, in making the dissection it is better to err in leaving a bit of cervical tissue on the rectal wall rather than vice versa. Another point to be stressed is that resection of part of an ovary is often a worth-while procedure in young women. In general, in dealing with other ovarian pathology a complete oophorectomy is preferable to resection if the opposite ovary is normal. This dictum does not apply too strictly to endometriosis in which bilateral ovarian involvement is the rule rather than the exception.

### MALIGNANCY IN ENDOMETRIOSIS

It is natural that a woman in whom endometriosis is diagnosed should ask, "What relation does this disease have to cancer?" The correct answer to this question probably is that ectopic endometrium may become malignant in rare instances, but it has no more proclivity to do so than endometrium within the uterine cavity. Let us examine the evidence:

Sampson recognized the possibility of malignant change in ectopic endometrium and in 1925 outlined the criteria necessary to such a diagnosis.

These were: (1) the coexistence of benign and malignant tissues in the same ovary which have the same histologic relationship to each other as in carcinoma of the body of the uterus; (2) the carcinoma must actually be seen arising in the benign tissue and not invading it from some other source; (3) additional supportive evidence includes the presence of tissue resembling endometrial stroma about characteristic epithelial glands and the finding of old hemorrhage rather than fresh. Among 516 cases of external endometriosis Scott and Te Linde found 8 cases of coexisting malignancy. In 6 of these the character of the malignant growth was of such a nature that it could not even have been suspected of arising from the endometrial tissue. In two, however, although Sampson's criteria were not entirely satisfied, histologic evidence strongly suggested that the carcinoma arose in the ectopic endometrium.

On reviewing the literature Thompson



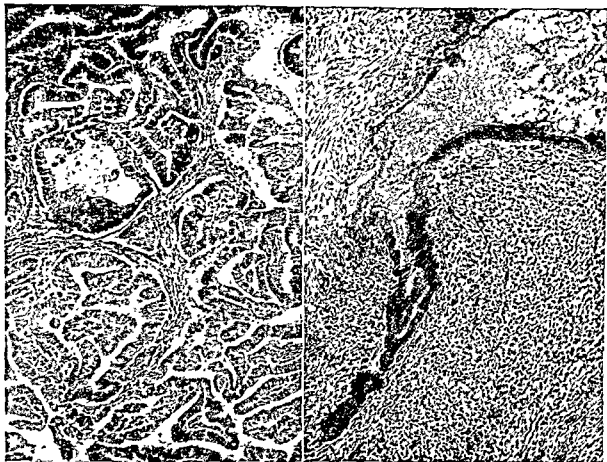


FIG. 295. (Left) Adeno-acanthoma found in ovary with extensive endometriosis. (Right) Endometrium including stroma in the ovary containing adeno-acanthoma.

found 20 reports of from one to several cases in which there seemed to be reasonably good evidence of a transformation of ovarian endometrium into malignancy. These represent a very small percentage when one considers the great number of cases of ovarian carcinomata and endometriosis. The most convincing evidence that endometriosis may undergo malignant change is presented in connection with adeno-acanthoma, a low-grade malignant lesion arising solely from endometrium. Thompson found that of 20 proved cases of malignant transformations of ovarian endometriosis, meeting Sampson's criteria, 9 were definite adeno-acanthomas. In these cases there was no adeno-acanthoma of the uterus, thus excluding the possibility of a metastatic lesion.

From the experience in our laboratory and elsewhere it would seem justifiable to conclude that endometriosis is capable of malignant change, but the incidence is extremely

low and is of little importance in the clinical management of patients with this condition. The most common ovarian malignancy arising from endometriosis is adeno-acanthoma.

In addition to malignant changes of endometrium in the ovary there are very rare instances reported in which malignant transformation has occurred in endometriosis in the rectovaginal septum. Lash and Rubenstein reported a case, and Dockerty *et al.* reported 2 cases from the Mayo Clinic. They were able to find only 5 other cases in the literature.

Of more clinical importance in considering malignancy in relation to endometriosis is the not-infrequent finding of a considerable enlargement of one or both ovaries in a case of obvious endometriosis. There, then, exists the possibility of a coexisting ovarian malignancy of independent type. When this occurs, one cannot afford not to explore, even though the patient is asymptomatic.

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# Presacral Neurectomy

## GENERAL CONSIDERATIONS

The operation of presacral neurectomy has been described in the literature under a variety of names: presacral sympathectomy, presacral neurectomy, resection of the presacral nerve and resection of the superior hypogastric plexus of Hovelacque. The operation was introduced by Jaboulay in 1898 but found little acceptance among gynecologists for many years. In 1925 Cotte began reporting on the operation and during succeeding years contributed many optimistic reports. In 1938 he reported 300 cases in which the operation had been done for primary dysmenorrhea, with success in all but 2. Since Cotte reports such a large series, it is obvious that his indications for the operation must be very liberal. The indications for presacral resection in this country, on the contrary, have been quite rigid for the most part; even from the larger clinics the number of cases reported is relatively small.

Our attitude toward the indications for the operation has been conservative. For primary dysmenorrhea we have used it only in the most severe cases and when conservative measures such as the use of nonhabit-forming sedatives, smooth-muscle relaxing drugs, cervical dilatation and, in some instances, psychotherapy have failed. Since our present attitude on the hormonal treatment of dysmenorrhea is a pessimistic one, few of our patients were treated by us with endocrine extracts, but many of them had been treated unsuccessfully before placing themselves under our care.

We have performed the operation more freely in connection with other procedures, such as suspensions, and conservative operations for endometriosis. In the endometriosis cases we believe that it should be done routinely whenever the uterus is not removed.

We have not used presacral resection for

the relief of pelvic pain associated with inoperable pelvic carcinoma. It is our belief that the origin of such pain is apt to be too widespread to expect much relief from removal of the superior mesenteric plexus. In such cases we prefer to have the neurosurgeons either inject or sever the pain nerve fibers of the cord.

Some gynecologists, including Henriksen, have extended the use of presacral neurectomy for the cure of *mittelschmerz*, *pruritus vulvae* and *dyspareunia*. We never have seen a case of *mittelschmerz* in which the pain was sufficiently severe to justify the operation. Perhaps it would be more nearly correct to say that in those cases of *mittelschmerz* in which the patients claimed very severe pain, we have concluded that the psyche played too great a role to make such patients good subjects for surgery. We have controlled *pruritis* by other methods. When *dyspareunia* is complained of, and no organic explanation is found, it generally should be concluded that the cause is psychic, and little can be expected from nerve resection.

In discussing an operation, the value of which is still not accepted universally, it is well to consider in some detail the operative results. Cotte claimed relief in all but 2 of 300 women on whom he operated for essential dysmenorrhea. In judging this report we cannot escape the conclusion that these excellent results, which are better than those reported from any other clinic, have been determined by a surgeon who is somewhat overenthusiastic about an operation of which he has been one of the chief promoters. In this country perhaps the most enthusiastic gynecologist is Greenhill, who states that "in severe dysmenorrhea, pelvic sympathectomy is almost 100 per cent successful." Ingersoll and Meigs report 81 per cent with complete relief, 4.5 per cent with partial relief and 14.5 per cent with no relief when

the operation was done for primary dysmenorrhea. In a group in which the operation was done for acquired dysmenorrhea, success was limited to 52.6 per cent. In a group of 68 patients with severe primary dysmenorrhea, Pfaneuf reports satisfactory results in 58 per cent and considerable improvement in 28 per cent. Counseller and Craig of the Mayo Clinic, reporting on 14 cases of essential dysmenorrhea, obtained complete relief in 9 cases, 95 per cent relief in 2 cases and 75 per cent relief in 3 cases. Henriksen, reporting on 42 cases of essential dysmenorrhea, obtained complete relief in 31 cases, some relief in 5 cases and no relief in 6. Rutherford has reported on 23 cases followed for 2 years. In 13 he obtained 100 per cent relief; in 6 there was 75 per cent relief; and in 4 there was 50 per cent relief. Colcock from the Lahey Clinic followed 35 cases for at least 6 months; 70 per cent were followed over a year. Twenty-eight cases were completely relieved; 6 partially relieved; and there was 1 failure. The most recent results have been reported from Switzerland by Erb and Hansen who report that the operation was done for severe dysmenorrhea in 118 patients, two thirds of whom had been unsuccessfully treated previously with hormones, physiotherapy or both. Follow-up studies were available in 85. Freedom from symptoms or considerable improvement was achieved in 73 per cent, and slight improvement in 9 per cent, whereas the operation failed in 18 per cent.

These results from excellent clinics show, without doubt, that on the whole the results are satisfactory when the operation is used in selected cases of essential dysmenorrhea. All of the above-quoted American authors agree with us in our attitude of conservatism in performing the operation only on those cases in which other measures have failed.

It is more difficult to evaluate results when the nerve resection is performed in connection with other operative procedures, which are also done for relief of pain. Those gynecologists who have expressed themselves on the subject hold the opinion that it is a worth-while procedure, especially in connection with conservative operations for endometriosis in young women.

It is the universal opinion of the above-mentioned authors that the operation is quite

harmless in its effect on the function of the bladder, the bowel and the uterus; no effect has been noted on menstruation except to make it less painful. Many labors following this operation are virtually without pain except momentarily as the baby passes through the perineum.

## ANATOMY

It is obvious from reviewing the literature on the subject of presacral resection that the surgeons performing the operations have none too clear a conception of the nervous anatomy. Recognizing this fact, Curtis, Anson, Ashley and Jones have made dissections on cadavers and have described and illustrated beautifully the anatomy of the pelvic autonomic nerves. The following is a direct quotation from their anatomic description:

The lumbar and lower thoracic sympathetic ganglia, and the superior, middle and inferior hypogastric plexuses constitute the sensory pathways from the pelvic viscera. A most important exception in gynecology is that the nerves from the ovaries, similar to their vascular supply, pass somewhat independently to the inferior mesenteric plexus, as do the sensory fibers from the lower bowel and fallopian tubes. . . .

At the level of the bifurcation of the aorta the intermesenteric nerves join to form the superior hypogastric plexus, more commonly known as the "presacral nerve," which is the chief supply of the bladder, the rectum and the internal genitalia except the ovary and part of the fallopian tube. The location and relations of the superior hypogastric plexus are important because its removal is frequently resorted to for relief of intractable pelvic pain. It is usually a moderately wide plexus formed from two or three incompletely fused trunks of the intermesenteric nerves. In perhaps 20 per cent of the cases there is complete fusion, with resultant formation of a single nerve. The superior hypogastric plexus spreads out behind the peritoneum in a bed of loosely meshed areolar tissue which lies upon the bodies of the 4th and 5th lumbar vertebrae. In the midline the middle sacral artery is situated between the nerves and the anterior surface of the vertebral bodies. There is a bilateral communication between the "presacral nerve" and the lumbar sympathetic ganglia by means of fine nerve strands which pass from the ganglia to the nerves located behind the common iliac arteries.

The superior hypogastric plexus may or may not form a middle hypogastric plexus; when

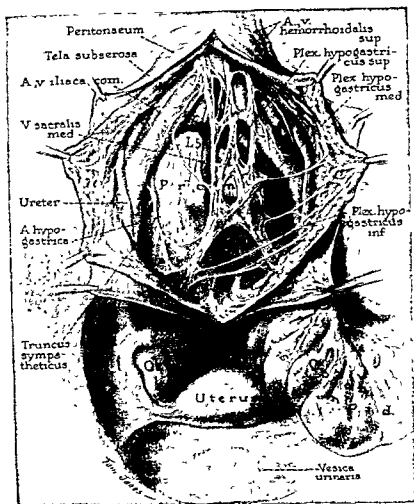


FIG. 296. Presacral nerves, in relation to peritoneal tissues. Anterior view of pelvis. Removal of the peritoneum and the retroperitoneal tissues, by strata, demonstrating the relation of the more prominent automatic elements to the heavy (deep) layer of retroperitoneal tissue. (Curtis, A. H.: *A Textbook on Gynecology*, Philadelphia, Saunders)

present the plexus is a flat expanse of neurofibrous tissue overlying the promontory and extending just below it; this plexus divides to form the bilateral inferior hypogastric plexuses, or hypogastric nerves. Each consists of two or three interlacing nerves, forming a low narrow plexus. The fibers of the inferior hypogastric plexus pass downward and lateralward near the sacral end of the uterosacral ligament, then forward over the lateral surface of the rectal ampulla to join the pelvic plexus, sometimes known as the uterovaginal plexus, the cervical ganglion, or the ganglion of Frankenhäuser, of which the hypogastric plexus furnishes the main sympathetic supply. The additional nerve supply to the pelvic plexus consists of fine fibers from the sacral sympathetic chain and parasympathetic branches (erigen or pelvic nerve) usually arising from the anterior roots of the sacral nerves. . . .

The ovary derives its nerve supply mainly

from the ovarian plexus, a meshwork of nerve fiber bundles which arise from the aortic and renal plexuses and accompany the ovarian artery throughout its course. The high source of the ovarian nerve supply is, as should be expected, with realization that the ovary is embryologically an abdominal organ. The ovarian plexus invests both the ovarian artery and the vein. It supplies fibers to the broad ligament and to the fallopian tube, as well as to the ovary, and communicates in the broad ligament with the pelvic plexus; through the latter plexus it supplies fibers to the uterus.\*

Figure 296 demonstrates the above-described hypogastric plexuses as they appear in a typical dissected specimen.

\* Curtis, A. H., Anson, B. J., Ashley, F. L., and Jones, Tom: *The anatomy of the pelvic autonomic nerves in relation to gynecology, Surg., Gynec. & Obst.* 75:743-745, 1942.

## TECHNIC: PRESACRAL NEURECTOMY

The operation is performed under general anesthesia through a mid-line incision beginning at the level of the umbilicus. Curtis advocates an incision extending well above the umbilicus. If the patient is obese this may be necessary, but in thin individuals we have had no difficulty in getting adequate exposure with an infra-umbilical incision.

The bowel is packed well back, and the rectosigmoid is drawn to the left. A mid-line incision is made in the posterior parietal peritoneum, from a point above the bifurcation of the aorta to a point in the hollow of the sacrum opposite the 3rd or the 4th sacral vertebra. The retroperitoneal exposure is made by placing guy sutures on the edges of the peritoneum or by holding the edges apart with mucosa clips. Usually, exposure of the right ureter and the inferior mesenteric vessels is accomplished easily. Beginning on the right, all retroperitoneal connective tissue is dissected free between the right ureter and the inferior mesenteric vessels. A blunt dissector of some type is best for this dissection and minimizes bleeding. Two distinct layers of nerve-containing connective tissue are usually recognizable. The upper layer must be dissected free from the peritoneum. The deeper layer, which contains the main nerve trunks, is dissected from the vessels and the periosteum. Henriksen has suggested using an ordinary orange-wood stick. The dissection is carried up to the origin of the inferior mesenteric artery, where the plexus is divided, and bleeding is controlled by fine catgut ties. The operator must avoid injury to the inferior mesenteric artery and its superior hemorrhoidal branch. All retroperitoneal nerve-containing tissue should be removed down to the level of the 2nd sacral nerve. The middle sacral artery, which is closely attached to the bony structures, usually escapes

injury with the blunt dissection, but if it should be injured, usually bleeding can be stopped readily by making pressure directly against the subjacent bony structures. On a few occasions we have placed jelofoam in the retroperitoneal space to control oozing. After removal of the connective tissue and the nervous tissue, hemostasis is attended to, and the opening in the peritoneum is closed with a continuous suture of No. 0 plain catgut.

## OVARIAN DENERVATION

Perhaps it would not be proper to conclude a chapter on the role of neurosurgery in dysmenorrhea without mentioning ovarian sympathectomy. Some gynecologists recognize the clinical entity of ovarian dysmenorrhea. The ovarian pain may be unilateral or bilateral and is said to be chiefly premenstrual but may be menstrual. Nausea is said to be an almost constant symptom. In our own experience a sharp differentiation between primary uterine and primary ovarian dysmenorrhea is not a simple matter and often is impossible. O'Donel Browne, of Dublin, make such a differentiation and treats the severer cases of ovarian dysmenorrhea by ovarian denervation. His technic consists of division of both infundibulopelvic ligaments, their nerves and blood vessels, and simple ligation of the stumps with catgut. To avoid elongation of the divided ligaments with subsequent prolapse of the ovaries, the cut ends are sutured together. Of 21 ovarian denervations, he reports 14.2 per cent failures, 4.7 per cent partial successes and 80.9 per cent successes. Our own experience with this operation is not sufficient to evaluate these results in the light of our own practice. The subject is discussed briefly here simply to call attention to a procedure which may or may not prove to be of value when tested by the gynecologic profession.

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# Gonorrhea and Its Complications

From the standpoint of treatment, gonorrhea in the female may be regarded as a disease of 2 stages. In the first stage, there is involvement of one or more of the following organs: the cervix, the urethra, including Skene's ducts, and Bartholin's glands. In the second stage of the disease, the infection passes the barrier of the internal cervical os and involves the endometrium, the tubes, the ovaries and the peritoneum. Although it is quite impossible to estimate accurately the percentage of cases in which the disease passes the internal os, it is obvious that in the majority of cases the second stage of the disease never occurs. A comparison of the number of cases of salpingitis with the number of cases of lower-tract gonorrhea in any clinic would not give a fair idea of the incidence of upper-tract involvement, because the majority of the cases of cervicitis and/or urethritis never come to a clinic or a physician for treatment.

## GONORRHEAL DISEASE OF THE LOWER TRACT

The cervix, in our experience, is the organ most commonly involved, but opinion differs on this point. Some gynecologists believe that the urethra is infected most frequently. Our conclusion is based on the fact that we commonly see neisserian cervicitis alone; we frequently see cervicitis and urethritis concomitantly, but rarely do we see urethritis as the only lesion.

### LABORATORY EVIDENCE OF INFECTION

Before treatment is instituted, every effort should be made to establish or rule out with certainty the diagnosis of gonorrhea. All too often treatment is begun on incomplete evidence, and if doubt arises afterward, the question may be impossible of settlement.

An attempt should be made immediately to prove bacteriologically the presence of the gonococcus. Both smears and cultures should be taken. It has been the experience of Long, working in our clinic, that a culture is about 70 per cent more reliable as a diagnostic procedure than a smear. More recently, Koch found 13 per cent of the cases, which were clinically thought to have neisserian infection, to have positive smears, whereas 40.4 per cent of the same group had positive cultures. The superiority of culture over smear is also borne out by the experience of Gillick, Sulkin and Stephens, who found smears positive in 50 per cent of reasonably sure cases of gonorrhea and the cultures positive in 80 per cent. They warn against the use of lubricants on the speculum when taking cultures and ascribe the many failures to grow the gonococcus to the effect of the lubricating jelly. The only cases in which they obtained positive smears and negative cultures were those in which lubricants were used. Since there is the possibility of a positive smear and a negative culture, one never should neglect careful examination of the smear in all suspected cases. It is obvious that the smallest percentage of errors will occur when both smear and culture are used. The results of smear and culture must be considered with reference to the duration of the disease. If the onset of symptoms has been recent, that is, only a few days before examination, the chances of identifying the gonococcus by smear and/or culture are excellent. The more time that elapses between the onset of the infection and the taking of the smear, the poorer are the chances of identifying the organism in smear or culture. If the symptoms are a month or more old, the chances of identifying the organism in smear or culture are slight, unless there has

been repeated infection. Smears and cultures from the cervix should be taken from the cervical canal. Smears and cultures from the urethra should be taken by introducing a swab into the external portion of the canal. Then the urethra should be milked, and Skene's glands, especially, should be compressed. Any secretion obtained by this method is cultured. Sometimes Skene's glands harbor the organism many months after the onset of the infection, when ordinary urethral cultures and cervical cultures are negative.

The identification of the organism in cervical smear is not in every instance a simple matter. The smears always should be stained by the Gram method. Identification of the organism may be difficult, even with the help of the Gram stain; with a methylene blue stain it is impossible, unless the typical intracellular arrangement is seen. Identification of the gram-negative organisms outside of the pus cell is difficult, particularly when they are sparsely distributed. The expert may be relatively sure of the identification; the novice can easily err. It should be remembered that the gonococcus is larger than most of the other cocci found in the lower genital tract, and it occurs in characteristic biscuit-shaped pairs. If extracellular organisms meeting this description are found, one should continue to search for intracellular ones, and often they will be found. The importance of the examination of repeated smears should be emphasized. When the clinical history and/or examination are suspicious and the smears and the cultures prove to be negative, they should be repeatedly made and examined. Strauss, Horowitz and Grunstein were able to increase the percentage of positive results from 45, when only one culture was taken, to 60 when repeated cultures were made.

Recently, real progress has been made in methods of culture of the gonococcus, greatly increasing the percentage of positive results. The method perfected and used in our clinic by Koch is given in some detail because it has proved to be of great diagnostic assistance to us.

#### LABORATORY METHODS

**Preparation of Media.** 1. *Semisolid dextrose starch agar* (carrying medium) 0.2

per cent agar is added to bacto-dextrose starch (Difco). The pH is adjusted to 7.6-7.8, tubed in 5 cc. amounts and autoclaved at 15 pounds of pressure at 121° C. for 20 minutes.

2. *Chocolate blood pancreatic digest agar.* To each 250 Gm. of fresh lean meat, 100 cc. of distilled water and 5 Gm. of sodium chloride are added. This is heated to 50° C., and 2.5 Gm. of pancreatin is stirred into a cup of the above fluid. This is digested with occasional stirring at 50° to 56° C. for 2 hours. The mixture is strained through 2 layers of fine cotton gauze. Then it is boiled for 5 minutes and filtered through coarse filter paper. The volume is restored to 1,000 cc. by the addition of distilled water. The reaction is adjusted to about pH 7.6 and brought to a boil. The solution is filtered through paper while hot. The reaction is checked and adjusted if necessary. The solution is distributed into tubes, flasks or bottles and sterilized in the autoclave.

This medium serves all the purposes of infusion broth, is more economical and does not require the use of commercial "peptone." It may be used as a base for making agar or semisolid media.

For pancreatic digest agar, 1.5 per cent agar is added to the pancreatic digest broth. This mixture is boiled 1 minute, and the pH is adjusted to about 7.6. It is tubed or dispensed in flasks and autoclaved at 15 pounds of pressure for 20 minutes.

When ready for use, the "flasked" agar is melted, cooled to 56° C., and to each flask is added 10 per cent of defibrinated or citrated human blood. This is mixed well and placed in a water bath at 85° C. The flasks are rotated until the blood is a smooth chocolate brown. The medium is poured into Petri dishes and allowed to solidify. Plates should be made fresh daily.

3. *Semisolid agar for fermentation tubes.* To 1,000 cc. of pancreatic digest broth, 4 Gm. of agar are added. The mixture is clarified and adjusted to a reaction of pH 7.4 to 7.6 Phenol red (2% aqueous solution in 20% ethyl alcohol) is added in the proportion of 5 cc. per liter of medium. It is distributed in flasks in 1,000 cc. amounts and sterilized in the autoclave. Before use, 20 per cent of sterile ascitic fluid and 5 cc.

of a 10 per cent solution of the proper sugar, which has been sterilized previously under petrolatum, are added aseptically. The ascitic fluid should be heated to 56° C. for 1 hour before adding. The medium is distributed in 5 cc. amounts, aseptically in test tubes, and incubated aerobically and not in CO<sub>2</sub> jars.

**Methods of Culture.** The material from the urethral meatus or the cervix is collected on a dry cotton swab and immersed in a sterile test tube containing 5 cc. of semi-solid dextrose agar. This carrying medium will preserve the gonococcus for several hours but will not promote growth. Specimens are plated on chocolate-blood, pancreatic digest agar plates. The swabs are rotated over a small area of the plate, and then a loop is used to spread the inoculum over the medium, in order to obtain isolated colonies. The inoculated plates are incubated in a CO<sub>2</sub> jar for 48 hours at 37° C. The proper CO<sub>2</sub> content may be maintained by the use of a tank of CO<sub>2</sub> and a pump manometer system. A glass jar is used and made airtight by the use of plasticine. Moisture is maintained inside the jar by the use of moist cotton.

**Examination and Identification of Cultures.** Oxydase tests are made by the use of 1 or ½ per cent para-aminodimethylaniline-monohydrochloride. The reagent is measured out in 0.1 or 0.05 Gm. amounts and dissolved in 10 cc. of water. This solution is made just before use and is allowed to stand for 15 minutes. The reagent is applied to only part of the plate, so that similar untouched colonies may be fished for further identification. If the organisms have produced oxydase, this enzyme will convert the reagent into a colored compound that will turn the colony first pink and then black. When the colony turns black, the organism is dead. Microscopic confirmation of oxydase positive colonies is essential to determine the presence of gram-negative diplococci, because the reaction is also given by certain diphtheroids and a few gram-negative bacilli.

The colony formation of the gonococcus on the chocolate-blood, pancreatic digest agar is quite characteristic. After 48 hours of incubation at 37° C. in a CO<sub>2</sub> jar, the colonies appear round, convex, slightly

opaque and of a fair size. They have a wet, glistening appearance and tend to stick to the needle, forming threads, when being transferred. In contrast, the colonies formed by the gram-positive cocci are large, round, white and opaque, while the gram-negative bacilli form very small round colonies, slightly more opaque than the gonococcal colonies.

Final identification of the organism is done by fermentation tests. The gonococcus ferments only dextrose, while the meningococcus ferments both dextrose and maltose. Cultures are incubated aerobically in the sugars, and not in a CO<sub>2</sub> jar, for 5 days at 37° C.

**Complement Fixation.** Before leaving the question of the laboratory diagnosis of gonorrhea, the complement-fixation test should be considered in order to evaluate its clinical importance. The literature is very very contradictory on the question of its clinical value. Brunet and Levine surveyed 1,000 complement-fixation tests done in an outpatient clinic. They concluded that, in the absence of seropositive syphilis, a persistently positive complement-fixation test establishes gonorrhea. However, they admit that a large percentage of cases known to have gonococcal activity give negative results. Koch recently tested the sera of 1,127 women in our clinic with presumptive or bacteriologically proved gonorrhea. In a control group of 100, composed of medical students and laboratory technicians, only one positive test was found. In the large group of cases in whom gonorrhea was clinically supposed to be present or was proved bacteriologically, 28.1 per cent had positive complement-fixation reactions. Of the cases that were bacteriologically proved to have gonorrhea, 36.7 per cent had positive reactions. From the above data it is apparent that a negative reaction is of no value in ruling out a neisserian infection, either acute or chronic. However, since the control individuals showed 99 per cent negative reactions, it seems reasonable to accept a positive reaction as indicative of a present or recent gonococcal focus of infection. As a test of cure, a negative reaction is of value only if previous reactions have been positive. To sum up our present views on the test, we would say that the gonococcus complement-

fixation test is quite specific but is unreliable clinically as a test for neisserian infection because of the large number of negative results in bacteriologically proved gonorrhea.

### CLINICAL EVIDENCE OF INFECTION

From the above discussion, it is apparent that the laboratory tests for the diagnosis of gonorrhea of the lower genital tract often leave much to be desired. Laboratory results should be interpreted carefully in the light of the history and the physical findings. Indeed, in some instances, particularly in the less acute cases, the diagnosis must be established or ruled out entirely on clinical grounds, since negative cultures and smears are not conclusive evidence of freedom from gonorrhea. Since the disease is almost invariably acquired by direct sexual contact, it is important to ascertain whether or not there has been recent sex activity. Not infrequently a virginal woman who develops a vaginal discharge will fear that she has innocently acquired gonorrhea and will consult a gynecologist. If examination confirms her virginity, and cervical and urethral smears and cultures are negative, one may decide quite conclusively that there is no neisserian infection. If examination indicates that she is not virginal, she should tactfully be given an opportunity to tell the true story. The importance of learning the truth in relation to the diagnosis usually can be put to the patient so that eventually she will confess her latest exposure. If vaginal discharge and/or burning and frequency of urination have developed following a clandestine or extramarital exposure, and the laboratory examinations are negative, it is of the utmost importance to make contact with the male and have him examined for gonorrhea. Occasionally, it is necessary to treat a woman who has been exposed to an infected male and has developed symptoms suggestive of gonorrhea on circumstantial evidence, when all laboratory tests are negative.

Examination of the recently infected woman may show a thick yellowish discharge coming from the vagina and/or the urethra. The urethral meatus may be edematous, and Skene's ducts may even be swollen by abscess formation. Bartholin's glands may be enlarged due to acute inflammation, and even large abscesses may develop in

them. On the other hand, any or all of these signs are sometimes absent. The author has had the experience of obtaining a smear from a normal-looking cervix from which only clear mucoid secretion was coming and finding it loaded with intracellular gonococci. Positive smears have also been obtained from normal-appearing urethras.

In searching for evidence, when chronic infection is suspected, one inspects and palpates Bartholin's and Skene's glands. The normal Skene's ducts are not palpable. After neisserian infection, they may be thickened and even form chronic abscesses that discharge pus when compressed. Abscesses starting in Skene's ducts sometimes burrow between the urethra and the vaginal mucosa and form large suburethral abscesses. The infection occasionally is persistent in the urethra. Endoscopic examination may show small areas of granulation tissue along the course of the urethra. Normal Bartholin's glands are usually not palpable, or are palpable only as small structures about the size of kernels of wheat. When larger than this, there is a suspicion of infection, present or past. Bits of granulation tissue at the orifices of Bartholin's or Skene's ducts suggest old neisserian infection but are not pathognomonic of the disease.

Chronic neisserian infection of the cervix is not characteristic on inspection. It may appear exactly like any other chronically infected nulliparous or parous cervix. Indeed, the portio often looks perfectly normal. Infection is harbored deep in the cervical glands, most of which open into the cervical canal. Some open on the portio, and the openings of these may become occluded, forming nabothian cysts, but these differ in appearance in no way from those resulting from nonspecific infection.

### THE TREATMENT OF GONOCOCCAL INFECTION OF THE LOWER TRACT

In all cases of acute gonococcal infection of the lower genital tract, rest in bed is desirable. It is difficult of proof, but we believe that the incidence of involvement of the upper tract is reduced by rest. Avoidance of repeated unnecessary bimanual examinations is also desirable, and sexual continence is imperative. Topical applications to the urethral meatus and to the cervix are

useless and unnecessary. It is our belief that the introduction of an applicator into the cervical canal may, at times, force infected material above the internal os and favor the spread of infection to the upper genital tract. Warm douches keep the parts clean and are conducive to the patient's comfort. Opinion is not unified concerning the use of douches in the presence of acute neisserian cervicitis. No less an authority than Curtis disapproved of douches, believing that the fluid might carry infected material above the internal os. We cannot concur in this view, believing that the douche is quite harmless if given under low gravity pressure. There is probably little, if any, value in using a germicide in the douche, but we have commonly used potassium permanganate solution (1-5,000). It is likely that plain water would do as well. The gonococci lie deep in the cervical glands, and it is inconceivable that either a douche or surface application can eliminate the infection from the depths.

Penicillin has become the principal agent in the treatment of neisserian infections. Sulfonamides may be used with success in a large percentage of the cases, but there are fewer failures with penicillin. Douglas, Davis and Shandorf reported bacteriologic cures in 180 out of 185 cases treated with the sulfonamides. They reported 27 recurrences among 158 patients, but these were thought, for the most part, to be new infections. A gram of sulfadiazine given 4 times a day will usually give a bacteriologic cure in 48 hours, but treatment should be kept up for 10 days.

At first penicillin was used for the sulfa-resistant cases. The success was so gratifying in this group of cases that it has gradually replaced sulfa therapy in most clinics. It is our routine to use 300,000 units of penicillin twice daily. The cervical secretions are cultured and smeared and, although they are often negative in 48 hours, treatment is kept up for a total of 10 days. Very few cases will be encountered that are resistant to this therapy.

Other antibiotics also have a lethal effect on the gonococcus. For example, Salzberg, Caulkins and Hoge treated 18 cases of acute gonorrhea in women with a daily dosage of 750 mg. of streptomycin. Of the 18 cases

17 had negative smears within 48 hours. The 1 case that remained positive cleared up promptly with penicillin.

Chen, Dienst and Greenblatt treated 50 patients with bacteriologically proved gonorrhea with Aureomycin, giving 1 Gm. orally 3 times a day for 1 day. In a second group of 50 they gave the same dosage for 2 days. There was only one failure of bacteriologic cure in each group of 50. In spite of these prompt cures, we prefer penicillin because of its less toxic qualities and hence fewer side-effects.

#### TREATMENT OF RESIDUAL INFECTIONS IN THE LOWER TRACT

From what has been said above, it is obvious that the treatment of gonorrhea has been completely revolutionized by penicillin therapy. Less and less is necessary in the form of local treatment, and local instrumentation may do more harm than good. Sometimes a cervix that has been the site of a neisserian infection remains the source of a troublesome leukorrheal discharge, even though such discharge is bacteriologically negative. Such a cervix should be treated by cervical cauterization. For discussion of this see page 378.

Bartholin's gland infection usually responds to penicillin therapy, coupled with local measures for symptomatic relief in the form of hot douches and sitz baths. In spite of this, some glands will go on to abscess formation and require incision and drainage (Fig. 297). Occasionally, chronic infection may persist in the glands, and cyst formation is common, even when all activity of the original infection has long since passed. Excision of the chronically infected gland and/or the cyst is indicated. For the technic of excision of Bartholin's-gland cyst see page 738.

Urethral infections are usually short-lived; this was true even before the use of chemotherapy. Since the advent of penicillin, residual infection in the urethra or Skene's ducts is still rare, but all patients with neisserian infection do not have the benefit of chemotherapy, and residual infection in the urethra, in Skene's glands and in the sub-urethral space is seen occasionally. Small persistent foci along the urethra can be eradicated by local application of 5 per cent

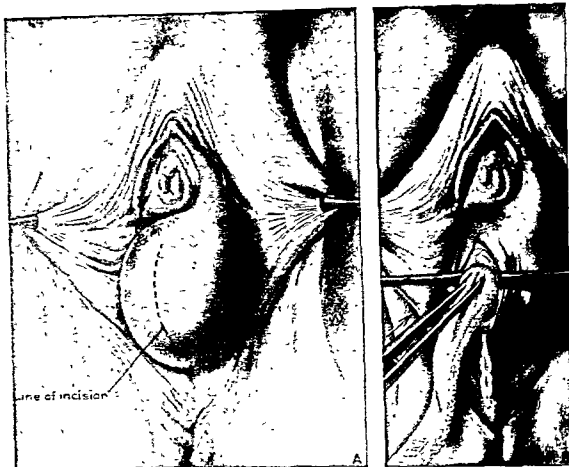


FIG. 297. Incision and drainage of Bartholin's-gland abscess. (A) Dotted Line indicates incision on mucosal surface. (B) Abscess cavity is packed with narrow gauze strip.

silver nitrate by means of cotton pledgets through the Kelly cystoscope. These local applications should be coupled with repeated courses of penicillin. When Skene's glands remain permanently infected, they may be destroyed by threading curved needles into the ducts and then destroying the ducts electro Surgically or with the actual cautery (Fig. 298). Suburethral abscess should be liberally incised from the vaginal side (Fig. 299). The author never has seen a urethral fistula result from such incision.

#### GONORRHEAL DISEASE ABOVE THE INTERNAL OS

After the cervix has become infected the course of the disease is variable. The disease in the cervix may persist as a chronic in-

fection, or the infection may die out completely, even without treatment. In some instances, probably in a small minority of the cases, the infection proceeds above the internal os and infects the endometrium. This is particularly apt to occur during menstruation when the blood in the uterine cavity serves as an excellent culture medium for gonococci. It is difficult to say why the infection remains localized in the cervix in some instances and ascends in others. However, it is our opinion that some of the factors favoring ascent of the infection are: frequent and unnecessarily rough bimanual examinations; coitus in the presence of acute cervicitis; local applications within the cervical canal; and possibly retroversion of the uterus. Soon after the endometrium is in-

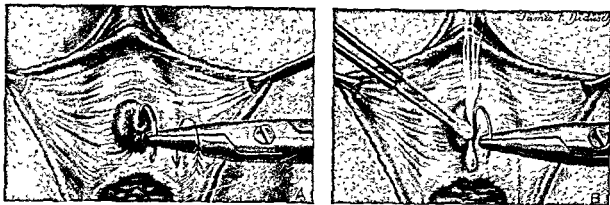


FIG. 298. Destruction of infected Skene's gland with cautery. (A) Curved needle is threaded into Skene's duct. (B) The gland is opened by cutting down to the needle. After the duct is opened it is thoroughly destroyed with the cautery.

fect, the salpinges become involved. Not until the tubes are actually inflamed do symptoms appear which indicate that the infection has ascended above the cervix. B-lateral lower abdominal pain, distention, muscle spasm, fever and leukocytosis are usually indicative of inflammation of the tubes and the pelvic peritoneum.

#### DIFFERENTIATION OF ACUTE SALPINGITIS FROM APPENDICITIS

One of the most frequent and most important differential diagnoses that the gynecologist is called upon to make is that between salpingitis and acute appendicitis. Hence, the subject is worthy of special consideration. If the abdomen is opened for appendectomy in the presence of acute salpingitis, the patient is subjected to needless surgery, although, as a rule, no great harm results, provided that the operator resists the temptation to remove the acutely inflamed tubes. Failure to open the abdomen in the presence of an acutely inflamed appendix may result in rupture and even death. The decision is frequently difficult because all of the symptoms of salpingitis may be present in appendicitis and vice versa.

Abdominal pain is usually the presenting symptom in both diseases. Characteristically, the pain due to appendicitis begins in the epigastrium and later localizes in the right lower quadrant. Characteristically, the pain due to salpingitis is low and bilateral. But often with appendicitis there are generalized abdominal cramps simulating the ab-

dominal pain due to gonococcal peritonitis. Many times the disease of the 2 tubes is unequal; when the right adnexa are involved to a much greater degree than the left, the

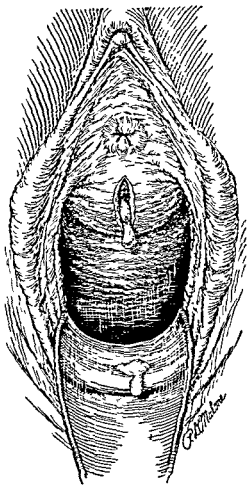


FIG. 299. Incision and drainage of suburethral abscess.

pain may be almost entirely right-sided, simulating that due to acute appendicitis.

*Nausea and vomiting* occur more frequently with acute appendicitis than with salpingitis, but they are by no means rare with the latter, especially in the more severe cases when considerable peritonitis is present. They may even be absent with an acutely inflamed appendix, and severe and persistent with acute salpingitis. In general, however, the absence of nausea and vomiting is a point in favor of salpingitis.

The degree of inflammation of the tubes is extremely variable and, in a like manner, there is great variation in *fever and leukocytosis*. The same may be said of appendicitis. The average temperature in both conditions is between 100° and 101°, but higher temperatures are commoner in salpingitis than in appendicitis, unless rupture has taken place and peritonitis or abscess has developed. Since the average elevation of the leukocyte count in both conditions varies between 10,000 and 20,000, there is generally little help to be obtained from the blood count in differentiating the two conditions.

*Intestinal distention* is common in both conditions. *Abdominal tenderness* is apt to be more localized in the right lower quadrant in the unruptured appendix, and the maximum is usually at McBurney's point. With salpingitis the tenderness is usually bilateral, although it can be far more marked on one side than on the other. If the maximum tenderness happens to be on the right, it may simulate tenderness from appendicitis, but its lower position is usually helpful in pointing to tubal inflammation. *Muscle spasm* is apt to be bilateral and low with salpingitis and limited to the right rectus region with appendicitis unless there is rupture with generalized peritonitis. Under these conditions the muscle spasm usually becomes generalized.

The *pelvic examination* is the most important procedure in making the differentiation. An unruptured hymen almost certainly rules out gonococcal salpingitis. Evidence of acute Bartholin or Skene adenitis, urethritis or cervicitis is strong evidence for salpingitis, particularly if the gonococcus is found in the smear from the cervix and/or

the urethra. Tenderness on bimanual movement of the uterus and thickening in the adnexal region strongly suggest tubal infection, but it should not be overlooked that very early in the course of the tubal infection there may be no induration, and that tenderness may be the only abnormality noted on pelvic examination. If the symptoms have been existent for a week or more, the absence of adnexal induration is evidence against salpingitis. Occasionally, in appendicitis, induration can be felt high up on the right through the vagina due to inflammatory thickening of the cecum, the ileum, the meso-appendix on an abscess. Although usually situated higher than a tubo-ovarian abscess, an appendix abscess may be as low as the cul-de-sac. If bimanual palpation reveals normal nontender adnexa on the left, that is strong evidence against salpingitis, which is practically always bilateral.

If acute appendicitis cannot be ruled out with reasonable certainty, it is better to err on the side of operative intervention than to defer surgery. Under such circumstances, the gridiron-muscle-splitting incision is preferred. The appendix can be removed satisfactorily through this type of incision and the right tube can be inspected satisfactorily. If an error in diagnosis is discovered at operation, the appendix should be removed, but the acutely inflamed tubes left undisturbed. The gridiron incision should be closed without drainage, even though very acute gonococcal peritonitis is present. Penicillin therapy should be started immediately.

#### TREATMENT OF ACUTE SALPINGITIS

Rest in bed in Fowler's position is imperative and undoubtedly of much value. The great number of cases of acute salpingitis encountered in the dispensaries in large cities makes it impossible to hospitalize all the patients, but ideally they should be hospitalized. As a substitute for hospitalization, rest in bed at home is prescribed. Improvement is the rule under such a regimen, but some of the patients with the most severe infections fail to improve. Such patients are hospitalized, and improvement usually follows. The inference is that such patients were not remaining in bed while at home.



Coitus and repeated pelvic examinations should be avoided.

Procaine penicillin in dosage of 300,000 units twice a day should be given. In most instances there is marked improvement within 48 hours, but therapy should be continued for 5 to 7 days even if the clinical response is almost immediate. If the response is not prompt, streptomycin 0.5 Gm. a day may be added and/or Gantrisin 1.5 Gm. every 6 hours. If necessary to continue treatment for more than a week, Kynex in dosage of 1.0 Gm. stat. and 0.5 Gm. per day is a convenient way of continuing the sulfonamide treatment with lesser dosage.

Douching with hot solutions, with the patient lying down, gives symptomatic relief, and it is our belief that the hyperemia caused by the heat promotes healing. Gallon douches of plain hot water are probably of as much value as douches containing antiseptics. A douche powder that we find agreeable to the patient is as follows:

#### PULVIS MENTHAE COMPOSITAE

Oil of peppermint	4 cc.
Liquefied phenol	8 cc.
Alum	30 cc.
Boric acid	120 cc.
M. et Ft. Pulv. No. 1.	

Sig: 2 teaspoonfuls to 2 quarts of warm water and use as a douche as directed.

Although this solution certainly has a minimum of antiseptic action, its pleasant "germicidal" odor seems to give the patient a sense of cleanliness that she desires. Sitz baths also give symptomatic relief.

Daily short-wave diathermy treatment is a more effective method of administering heat than by douching, and it is desirable when available. We find it of particular value in those cases that do not respond promptly to antibiotics and in those cases in which marked pelvic induration or large masses persist. The degree of resolution of pelvic cellulitis that can be attained with regular, persistent diathermy over weeks and even months is truly remarkable. Often diathermy will quickly bring pelvic cellulitis to abscess formation in the cul-de-sac, and the cul-de-sac is easily drained by colpotomy (Fig. 300).

It is the considered opinion of the author

and of most American gynecologists that *laparotomy should be avoided while tubal inflammation is still active because:*

1. It is usually unnecessary, since the majority of patients can be made comfortable by conservative measures and never will require surgery. In a series of cases treated by sulfonamide therapy by J. Herman Long in our outpatient department, only 11 per cent eventually required surgery. With penicillin therapy it is probable that a much smaller percentage will come to operation.

2. Pregnancy is not infrequently still possible after acute infection of the tubes, if proper conservative therapy is carried out. Nine per cent of Long's patients became pregnant during the first year of observation following the acute infection. Again, with penicillin treatment the percentage of subsequent pregnancies is probably higher.

3. The patients operated on during the acute or subacute stage have a higher mortality and morbidity than those operated upon for the inflammatory residue. Injuries to the bowel and the bladder are more common, and drainage, with its resultant adhesions, may be necessary; when operation is done on the residue, drainage is almost never necessary.

4. If surgery is undertaken during the acute or subacute stage, much more radical ovarian surgery is apt to be done. In spite of the best intentions for conservatism on the part of the operator, the appearance of the inflamed and often abscessed ovaries is such that he is more apt to remove both of them than he would be if he were operating after all active inflammation has subsided.

#### INDICATIONS FOR SURGERY DURING THE ACUTE STAGE OF SALPINGITIS

1. A fluctuant cul-de-sac abscess or a large tubo-ovarian abscess that does not respond to conservative treatment and is accessible to drainage through the posterior vaginal vault.

2. Rarely, the abdominal drainage of a large tubo-ovarian abscess is indicated when it fails to respond to conservative therapy and when it lies too high to be reached safely through the vagina. Such large thick-walled abscesses may fail to collapse and

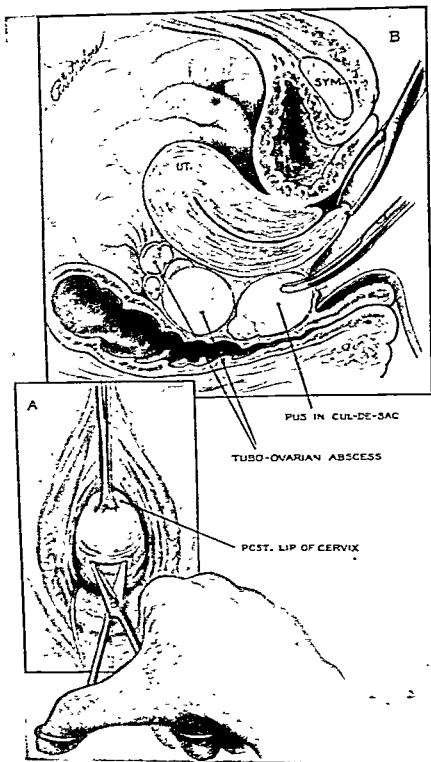


FIG. 300. Posterior colpotomy. (A) A transverse incision is made through the vaginal mucosa at the junction of the posterior vaginal fornix with the cervix. (B) A Kelly clamp is thrust through the abscess wall.

heal until drainage is established. It is our custom to open and drain them through gridiron incisions. This procedure is necessary only a few times a year on our service

in which pelvic inflammatory disease is common.

3. Rarely, a loop of small bowel may become adherent to an acute inflammatory

mass, causing obstruction and requiring operative intervention.

4. As mentioned above, the removal of the appendix may be necessary for safety in cases in which the symptoms and the signs are too suggestive of appendicitis to justify a watchful waiting policy.

#### TECHNIC: POSTERIOR COLPOTOMY

Posterior colpotomy is done to evacuate pus and to establish drainage from a cul-de-sac abscess or a tubo-ovarian abscess. It is also done in a search for blood when tubal pregnancy is suspected.

The patient is placed on the table in the lithotomy position, and the posterior lip of the cervix is drawn downward and forward. It is essential that a thorough examination of the pelvis be made under anesthesia, so that the operator will have in mind the size and the position of the mass that is to be drained.

With a long scissors, a transverse incision is made at the reflexion of the vaginal mucosa onto the cervix (Fig 300 A). Using a long Kelly clamp, the cul-de-sac is punctured (Fig. 300 B). As the abscess or hematoma wall is perforated, there is a definite sense of puncturing a cystic cavity; if blood or pus is present, some is soon seen in the upper vagina. The jaws of the clamp are spread, and the flow of liquid from the cul-de-sac is free. When puncturing an abscess, there is frequently more than one compartment, and it is desirable to insert a finger in the abscess cavity and explore. If another abscess wall is felt, often it may be punctured safely under the guidance of the finger. If pus is obtained, 2 cigarette drains are inserted into the abscess cavity. If necessary to control bleeding of the vaginal wall, a catgut stitch or two are taken in the vaginal incision.

#### SURGERY FOR THE RESIDUE OF GONOCOCCAL TUBAL DISEASE

The residue of gonococcal disease of the tubes is most variable. When the acute tubal infection results in only a slight endosalpingitis, regression of the infection may leave the tubes practically normal in appearance, with or without patent lumina. When the initial infection is more severe, peritubal adhesions usually follow, binding the tubes to the ovaries, the uterus, the bowel or the

pelvic wall. All trace of active infection often completely disappears. In other cases chronic infection persists in the walls of hydrosalpinges, old tubo-ovarian inflammatory cysts or chronic tubo-ovarian abscess.

Often the pelvic inflammatory residue is entirely asymptomatic. In some instances only slight discomfort persists, and the woman is kept relatively comfortable by hot douching and/or diathermy. With limited activity, she may be reasonably comfortable, only to become conscious of her pelvic discomfort on resuming normal activity. It is quite impossible to put an arbitrary time limit on conservative therapy before resorting to surgical interference, since much depends on the economic status of the woman and on her desire for children. One would have a tendency to interfere sooner in a working woman than in a lady of leisure who can, at will, limit her activity. In addition to pelvic discomfort, not uncommonly excessive or frequent uterine bleeding may call for operation. Partial or complete intestinal obstruction sometimes necessitates operation. The abdomen may be opened on rare occasions, in an attempt to establish the lumina of tubes for the cure of sterility.

The pathologic lesions found in the pelvis, responsible for the above-mentioned symptoms, are numerous. Some of the more frequent ones that require surgical correction are:

1. Adhesions in the adnexal regions
2. Adherent retroposed uterus
3. Intestinal adhesions causing partial or complete obstruction
4. Large hydrosalpinges and tubo-ovarian inflammatory cysts
5. Persistent old thick-walled tubo-ovarian abscesses
6. Rarely, ruptured old tubo-ovarian abscesses

#### SELECTION OF OPERATION

Having decided that operative intervention is necessary, the question of the proper operation is to be decided. Final decision never can be made except with the abdomen opened. Consideration must be given not only to the pathologic lesions found at operation but also to the patient's age, parity, desire for children, nervous and emotional status. Because a knowledge of all these

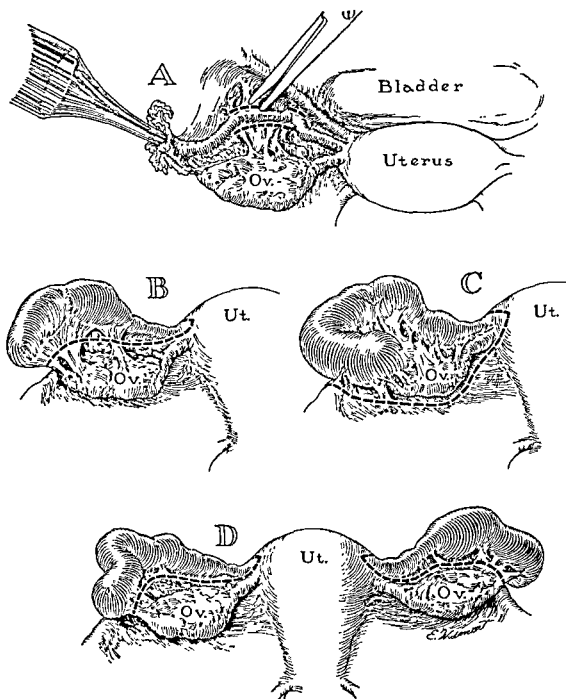


FIG. 301. Diagrammatic demonstration of possible operations for chronic salpingitis. (A) Release of peritubal adhesions. (B) Simple unilateral salpingectomy. (C) Unilateral salpingo-oophorectomy. (D) Bilateral salpingectomy.

is essential to the best surgical judgment, it is desirable for the operator to be thoroughly familiar with the history.

Figure 301 illustrates the possible operative procedures for the residue of salpingitis.

In addition to those pictured, there is the cornual tubal resection discussed and illustrated later in this chapter. The least surgery that can be done on a pelvic inflammatory residue is release of peritubal and peri-

ovarian adhesions. This is indicated occasionally in women in whom childbearing is desired, provided that the tubes can be demonstrated by retrograde tubal inflation

with the abdomen open to be patent after the adhesions have been cut. It is uncommon to find both tubes in such a condition that their lumina can be restored so simply. More

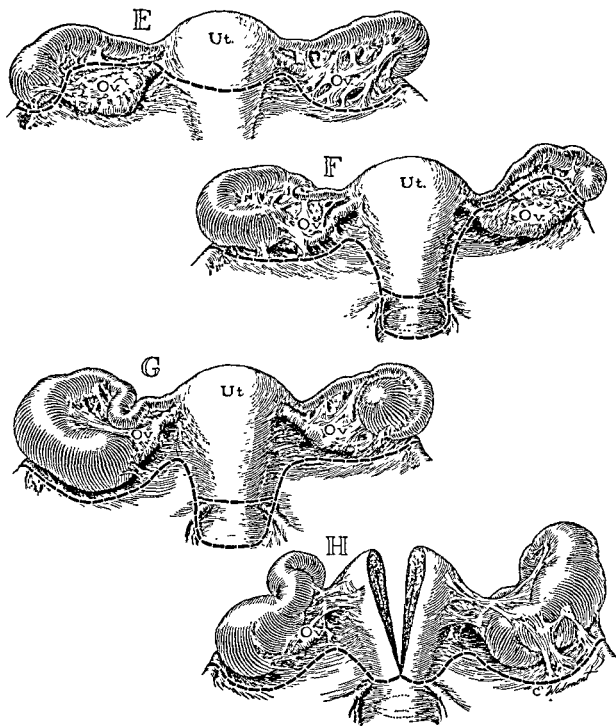


FIG. 301 (Continued). Diagrammatic demonstration of possible operations for chronic salpingitis. (E) Double salpingectomy, unilateral oophorectomy. (F) Double salpingectomy, unilateral oophorectomy and hysterectomy, total or subtotal. (G) Double salpingo-oophorectomy and hysterectomy, total or subtotal. (H) Bisection operation with complete adnexal ablation.

frequently, one tube is hopelessly closed, and the opposite one is patent after release of adhesions. Then unilateral salpingectomy may be indicated, if preservation of the childbearing function is desirable. In a case in which the uterus is in retroposition and adherent, but the tubes patent, the adhesions should be released, and some type of suspension compatible with future pregnancy should be carried out.

In the majority of instances bilateral salpingectomy is necessary. Frequently one and occasionally both ovaries must also be removed. Since most operations for pelvic inflammatory disease are done on women under 35 years of age, the condition of the ovaries should be considered carefully before deciding upon bilateral oophorectomy. The decision to castrate should be made from the standpoint of the pelvic lesions and also after a consideration of the age and the nervous temperament of the patient. Our attitude toward bilateral ovarian removal is very conservative. The author, in collaboration with Darner, followed a series of women on whom hysterectomy was done for fibroids, mostly complicated by salpingitis. The percentage of patients free from abdominal discomfort was slightly greater in those in whom ovarian ablation was done (88%) than in those in whom ovarian tissue was conserved (84.4%). This slightly poorer figure for the conservative group was more than compensated for by the absence of hot flushes and nervous symptoms that annoyed a great portion of the group upon whom total ablation had been done.

When all the adnexa are removed it is our custom to perform a hysterectomy, unless there is a very good reason for conserving the uterus. The pelvis is usually peritonized more easily after removing the uterus, which often is covered with shaggy adhesions. Furthermore, a possible source of leukorrhea and malignancy is thereby removed. In very rare instances, when inflammatory masses are removed with great difficulty and the patient's condition on the operating table is precarious, discretion may dictate leaving the uterus in situ. In such instances it is our custom to perform a rapid ventral fixation of the uterus, rather than permit it to become adherent in retroposition. We believe that there is usually little

justification for the preservation of the uterus when a woman is to be sterilized by salpingectomy, if her condition permits the added surgery necessary to remove the uterus. In former years, preservation of the uterus was a common practice in our clinic. The great number of myomata, functional bleeding uteri and a small number of uterine carcinomata which we have observed in these sterile women have convinced us that there is little justification, in most instances, for preservation of the uterus. In all these women the cervix has been, or is, the site of infection; therefore, total hysterectomy is the ideal operation. However, this procedure should not be an invariable rule. In many women with a severe pelvic inflammatory residue the operation may be difficult, and discretion will dictate the subtotal hysterectomy rather than subject the patient to the further surgery necessary for removal of the cervix. This is particularly apt to be the case when the pelvic inflammatory residue is complicated by a large fibroid tumor. When an infected cervical stump is, of necessity, left in, conization is an excellent method of getting rid of the infected glandular portion of the cervix.

In spite of the very excellent reasons for hysterectomy with salpingectomy based on sound pathologic grounds, there is another factor that should enter into the decision. Before performing an operation for pelvic inflammatory residue, it is advisable to discuss the possibility of hysterectomy with the patient. A careful explanation to the sensible woman will usually cause her to consent to removal of the useless uterus, especially if dysmenorrhea or bleeding has been a prominent symptom. But unfortunately the emotions play a greater role than reason in many a woman's thoughts, and the idea of the absence of menstruation may suggest to her the loss of femininity and sex libido. Such ideas, unfounded as they may be, must be respected to prevent postoperative nervous upsets, and in such individuals preservation of the uterus is wise. If the serosal surface of the uterus is smooth, the entire organ may be saved, but if the uterus is covered with shaggy adhesions the Bell-Beutner operation of fundectomy will permit smoother peritonization (Fig. 305). By this procedure the likelihood of future myomata and func-

tional bleeding is also reduced, and yet some menstrual function is preserved.

When the uterus is preserved *in toto* or in part, a proper suspension is essential to prevent its becoming adherent posteriorly. Usually, the modified Coffey procedure pictured on page 554 is sufficient, but occasionally when there is a great tendency to retroversion, the modified Gilliam suspension may also be utilized to advantage.

Plastic operations for the restoration of tubal lumina for the cure of sterility are considered on page 617.

Special mention should be made of the treatment of ruptured old tubo-ovarian abscesses. Such abscesses may rupture spontaneously or as the result of bimanual examination or accidental trauma. They are secondarily infected by the colon bacillus and enterococci, and generalized peritonitis develops rapidly. If treatment is not instituted promptly, the mortality is very high. There is usually a history of acute sudden onset with sharp pain and, in a remarkably short time, the patient becomes seriously ill. Correct diagnosis is essential to prompt and proper treatment. The acute or subacute tubo-ovarian abscess is often associated with local or generalized peritonitis of gonococcal origin. This type of acute infection usually yields promptly to antibiotics, and surgery is seldom necessary. The peritonitis resulting from a ruptured old tubo-ovarian abscess or pyosalpinx is an entirely different disease caused by a different micro-organism. An important point in diagnosis is the recognition of the fact that the patient has had long-standing pelvic inflammatory disease. Often this can be suspected from the history and from the fact that the patient is older than the usual patient with her first attack of neisserian salpingitis. Most of our cases have occurred in the late thirties or early forties.

Whereas our results in former years were as bad as those generally reported in the literature, within the past 5 years they have been much better. We attribute this to the following:

1. Prompt use of the Levin tube pre-operatively and its continued use after operation.

2. The liberal use of intravenous fluids before and after surgery.

3. The prompt and continued use of antibiotics, usually penicillin and streptomycin.

4. Prompt surgery with removal of the tubo-ovarian abscess and abdominal drainage.

Although prompt surgical relief is imperative, a few hours of suction, hydration and antibiotic therapy before operation often greatly improve the condition of these acutely ill patients whose condition may resemble shock when they are first seen.

The preceding paragraphs, written in 1945, have been changed very little in this third edition. The principles of surgical treatment stated there still appear to the author to be sound. No mention was made of the Falk procedure of cornual resection in the treatment of recurrent salpingitis because it was believed that sufficient time had not elapsed for the evaluation of that operation. Falk based his treatment on the bacteriologic fact that gonorrheal infection of the endocervix reaches the tube by direct extension along the endometrium and the endosalpinx. Interruption of this epithelial surface would appear to be a logical way of preventing reinfection. Since it has been shown that gonococcal infection of the tube itself is self-limited, it would appear that the prevention of reinfection would be sufficient to permit healing of the tubal inflammation. Falk does not advocate cornual resection when tubo-ovarian abscess or severe cystic ovarian disease is present. He considers cornual resection to be superior to salpingectomy because it is a simpler operative procedure and because it is less apt to interfere with the ovarian blood supply and result in cystic ovaries. The operation also has been done during the relatively acute stage of the recurrent disease when salpingectomy would be contraindicated. Falk *et al.* report a clinical cure rate of 85 per cent with improvement in 14 per cent. They believe that reoperation for cystic ovaries is less frequent than after salpingectomy. Kimbrough and Freed reported clinical relief in 95 per cent.

Our current views on Falk's procedure are as follows: It is based on sound bacteriologic and histologic evidence, and his results speak for themselves. However, we have not found it necessary to do the operation *per se* very frequently. We have found the principle set



FIG. 302. Showing cornual excision of a diseased tube, according to Falk. Inset shows tube ligated and marks the line of excision. The picture proper shows that the cornual excision has been made and the wound closed with a figure-of-eight suture. The cornual end of the tube is being sutured to the anterior surface of the uterus.

forth by Falk to be very useful in dealing with fibroids, complicated by severe salpingitis. Not infrequently a hysterectomy in this type of case is greatly complicated by having to dig out the very adherent adnexa. Often after freeing such adnexa they are ragged, bleeding organs, and the operator is apt to conclude that they should be removed. If the tube is freed from such an adnexal mass the blood supply of the ovary is apt to be jeopardized. Thus, the freeing of such adnexal masses may result in radical surgery in the young. A hysterectomy for uterine disease is, in effect, a cornual resection. Thus, after hysterectomy frequently we have left the adherent adnexa on one or both sides in their adherent position. The author cannot recall that any of these adnexa have required removal at a later time.

On the other hand, if one adheres to the principles set forth in this chapter regarding surgical conservatism during the acute stage

of salpingitis, there will not often arise the necessity of cornual resection per se. When there is a residue of the old inflammatory process with severe pelvic adhesions, chronic tubo-ovarian abscess, hydrosalpinx, etc., surgical removal of the diseased tissues, resulting in a relatively smoothly peritonized pelvis, would seem to be a more logical procedure. The removal of the uterus along with the indicated adnexal surgery is also a decided advantage, especially in the colored race where uterine fibroids so commonly occur in later years. Finally, our experience with the formation of cystic ovaries after salpingectomy seems to have been more favorable than that of Falk.

Notwithstanding the above objections there is the occasional young woman who becomes infected repeatedly with gonorrhea to whom the preservation of all her pelvic organs is extremely important. Such an individual can be protected effectively from



future infection by cornual resection, bearing in mind the contraindications to the operation as stated by Falk. Figure 302 shows Falk's method of cornual tubal resection.

#### TECHNIC: SALPINGECTOMY

The adhesions binding the tube down are cut, and the tube is free. It is held up by a Kelly clamp placed on the mesosalpinx just

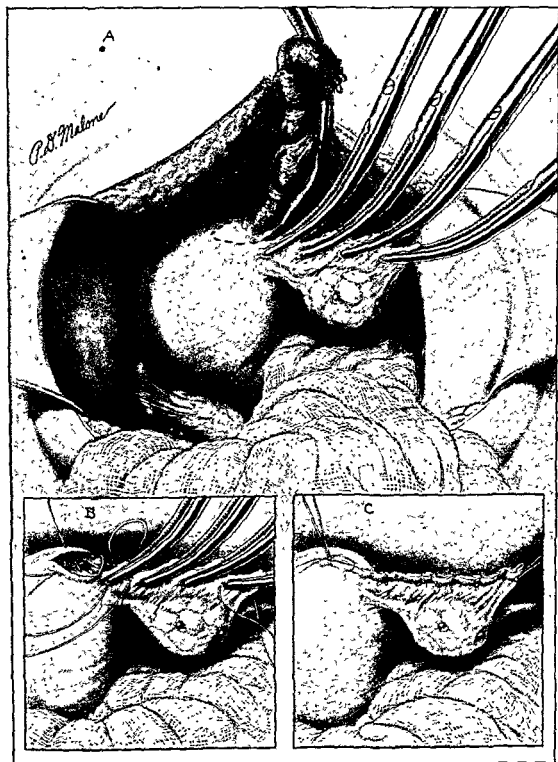


FIG. 303. Salpingectomy. (A) Mesosalpinx is clamped with multiple Kelly clamps and cut. Dotted line indicates cornual excision. (B) Cornual wound is closed with a figure-of-eight suture. (C) Mesosalpinx vessels are transfixed.

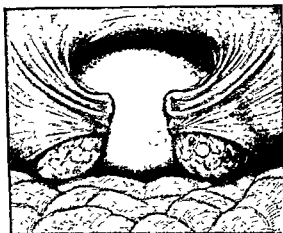
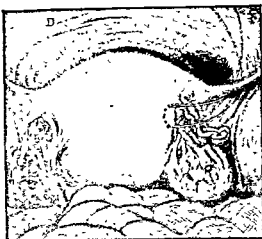


FIG. 303 (*Continued*). Salpingectomy. (D) Mesosalpinx has been turned back and sutured to cornu. Mattress suture is placed to cover operative area. (E) Round and broad ligaments cover cornual wound and mesosalpinx. (F) Modified Coffey suspension holds uterus forward and completely peritonizes operative area.

beneath the fimbriated end. The mesosalpinx is then clamped and cut, taking a succession of small bites as close to the tube as possible (Fig. 303 A). By keeping the operative trauma as far as possible from the ovary that is to be retained, there is less danger of imperiling its blood supply. Experience has shown that the ovary whose tube has been removed is more apt to become cystic than the ovary whose tube has been undisturbed. Therefore, it would seem logical to interfere as little as possible with the blood supply of the ovary by hugging the tube closely when excising it.

The tube is excised at the uterine cornu in a wedge-shaped manner as indicated by the dotted line in Figure 303 B. If there is palpable extension of the inflammation at the uterine cornu, the wedge may be rather large.

The wound at the uterine cornu is closed

with one or more figure-of-eight sutures of No. 0 chromic catgut. The vessels in the mesosalpinx are ligated with mattress sutures of No. 0 chromic catgut. The mattress suture has the advantage that it will not slip off the tissue when tied as the clamp is withdrawn (Fig. 303 C).

If the broad ligament is sufficiently pliable, the distal end of the mesosalpinx is sutured to the cornu. This bunches up the cut edge of the mesosalpinx so that it can be covered easily with the broad ligament.

A mattress suture of No. 0 chromic catgut is taken to bring the broad and the round ligaments over the cornual wound (Fig. 303 D). This suture passes just beneath the round ligament so that the ligament will not be strangulated when the suture is drawn tight. When this suture is tied, the cornual wound is covered with the broad ligament, and to some extent the uterus is suspended in a manner similar to that used in the Coffey suspension.

Usually a second mattress or interrupted suture is necessary to cover over the meso-

salpinx completely, as shown in Figure 303 E. **TECHNIC: SALPINGO-OOPHORECTOMY FOR CHRONIC SALPINGITIS**

At the conclusion of a bilateral salpingectomy the picture is as shown in Figure 303 F. The operative areas are completely covered with peritoneum. The uterus is held forward, and the ovaries are well suspended so that they cannot prolapse into the cul-de-sac.

The tubo-ovarian mass is first dissected free, and the infundibulopelvic ligament is identified. It is doubly clamped with Ochsner clamps, and a third clamp is applied to control back-bleeding (Fig. 304 A).

The infundibulopelvic ligament is cut, and the remainder of the broad ligament attach-

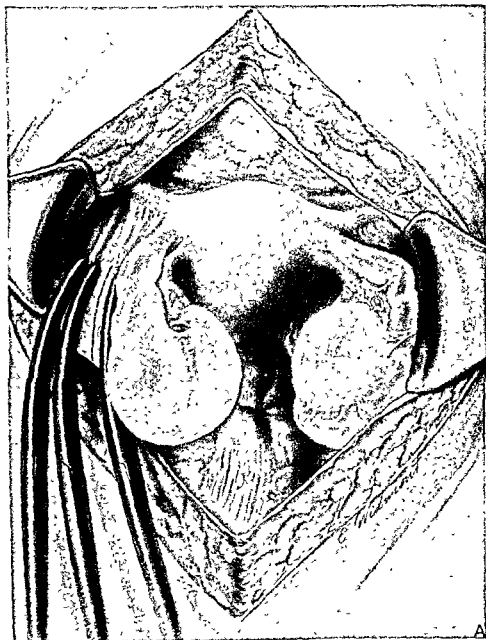


FIG. 304 Salpingo-oophorectomy. (A) The infundibulopelvic ligament is doubly clamped. Another clamp is placed to control back-bleeding. Dotted line indicates incision.

ment of the tube and the ovary is clamped and cut, as shown in Figure 304 B.

The uterine end of the tube and the ovarian ligament are excised from the uterus in a wedge-shaped manner as indicated by the dotted line in Figure 304 B.

The ascending uterine vessels are ligated just below the cornual wound, and the cor-

nal incision is closed with a figure-of-eight suture of No. 0 chromic catgut (Fig. 304 C).

The infundibulopelvic ligament is doubly ligated, and the vessels in the broad ligament are ligated with No. 0 chromic catgut.

The cornual wound is peritonized, and the uterus is suspended to some degree by bringing the round and the broad ligaments over



FIG. 304. (Continued). Salpingo-oophorectomy. (B) All of the mesosalpinx has been clamped and cut. Dotted line indicates wedge-shaped excision of tube and ovarian ligament at uterine cornu.

the uterine cornu with a mattress suture of No. 0 chromic catgut, as shown in Figure 304 D.

Figure 304 E shows the completed unilateral salpingo-oophorectomy.

#### TECHNIC: BELL-BEUTNER FUNDECTOMY

The removal of such part of the adnexa

as is deemed necessary is done in the usual manner. Then a decision is made as to how much of the corpus uteri should be removed. This decision depends on the condition of the uterus, such as the location of small fibroids or the degree of involvement of the uterus in the inflammatory process. The object is usually to remove the upper por-

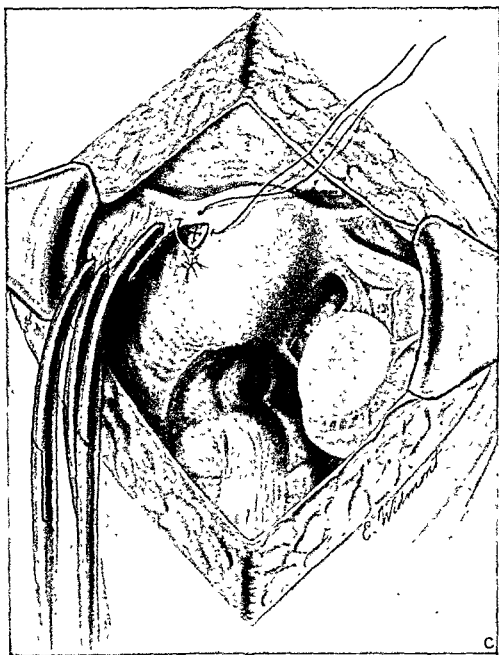


FIG. 304 (Continued). Salpingo-oophorectomy. (C) A suture has been placed so as to ligate the ascending uterine vessels just below cornual incision. The cornual incision is being closed with a figure-of-eight of No. 0 chromic catgut.

ment of the tube and the ovary is clamped and cut, as shown in Figure 304 B.

The uterine end of the tube and the ovarian ligament are excised from the uterus in a wedge-shaped manner as indicated by the dotted line in Figure 304 B.

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FIG. 304. (*Continued*). Salpingo-oophorectomy. (B) All of the mesosalpinx has been clamped and cut. Dotted line indicates wedge-shaped excision of tube and ovarian ligament at uterine cornu.

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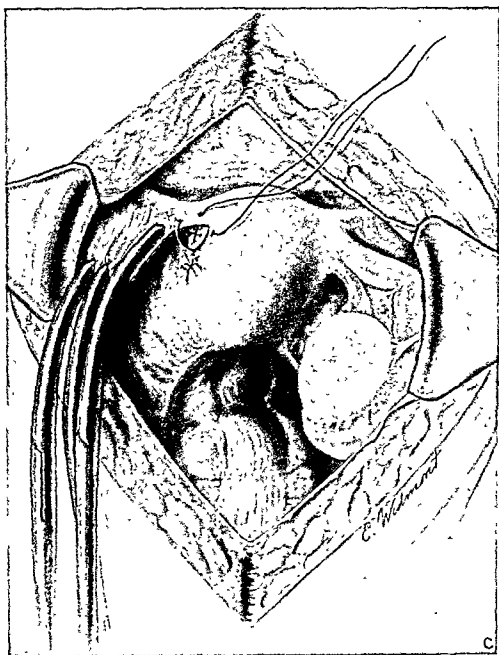


FIG. 304 (Continued). Salpingo-oophorectomy. (C) A suture has been placed so as to ligate the ascending uterine vessels just below cornual incision. The cornual incision is being closed with a figure-of-eight of No. 0 chromic catgut.

tion of the uterus that is covered with rough, shaggy peritoneum. The bladder peritoneal reflexion is cut across as high as possible. Since this peritoneum is to be used to cover the suture line in the uterus, as much of it as possible should be saved for that purpose. The bladder peritoneum is dissected down-

ward to mobilize sufficient for peritonealization.

The ascending uterine vessels are doubly clamped at the desired level with Ochsner clamps. Above that level a clamp is placed on either side to control back-bleeding. The fundus is excised in a V-shaped manner, and



FIG. 304 (Continued). Salpingo-oophorectomy. (D) Infundibulopelvic ligament and rest of broad ligament vessels have been ligated. Cornual wound is being covered with the round and the broad ligament, using a mattress suture of No. 0 chromic catgut.



the uterine vessels are doubly ligated with No. 0 chromic catgut. Figure 305 A illustrates the appearance of the operative field at this stage. The myometrium is approximated transversely with interrupted and figure-of-eight sutures of No. 0 chromic catgut. The ends of the round ligaments and the ovarian ligaments, if retained, are buried in the uterine incision as it is sutured. The

mobilized flap of peritoneum is then sutured to the posterior surface of the shortened uterus with No. 000 chromic catgut as shown in Figure 305 B.

#### TECHNIC: BISECTION OPERATION

If possible, the reflexion of the bladder peritoneum is cut at the beginning of the operation, and the bladder is pushed down

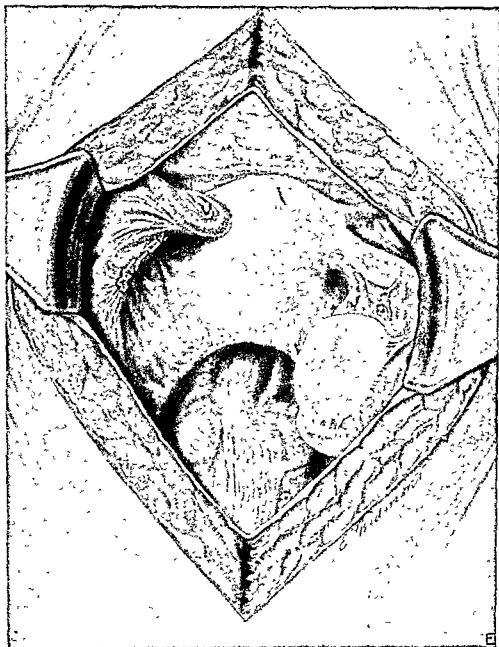


FIG. 304 (Continued). Salpingo-oophorectomy. (E) Shows operation completed on the left side.

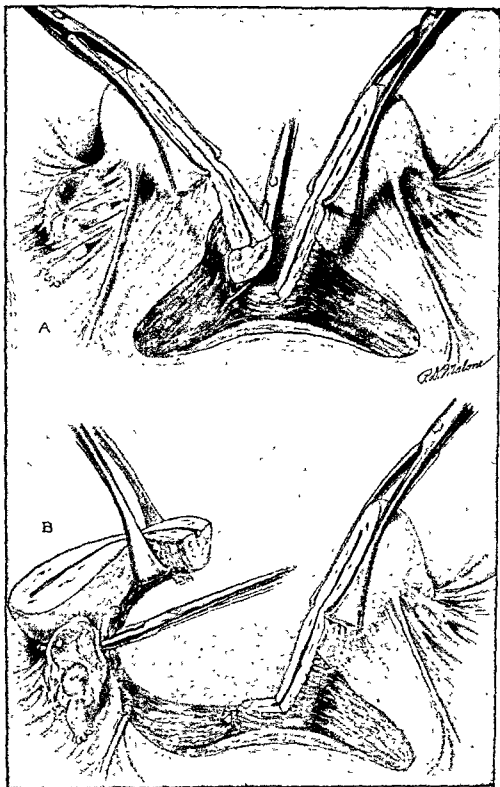


FIG. 306 Bisection operation. (A) The uterus has been bisected, and bleeding is controlled by grasping each half with vulsellum clamps. The right uterine vessel is being clamped. (B) Dissection has been carried laterally from below, and the infundibulopelvic ligament has been isolated and clamped.

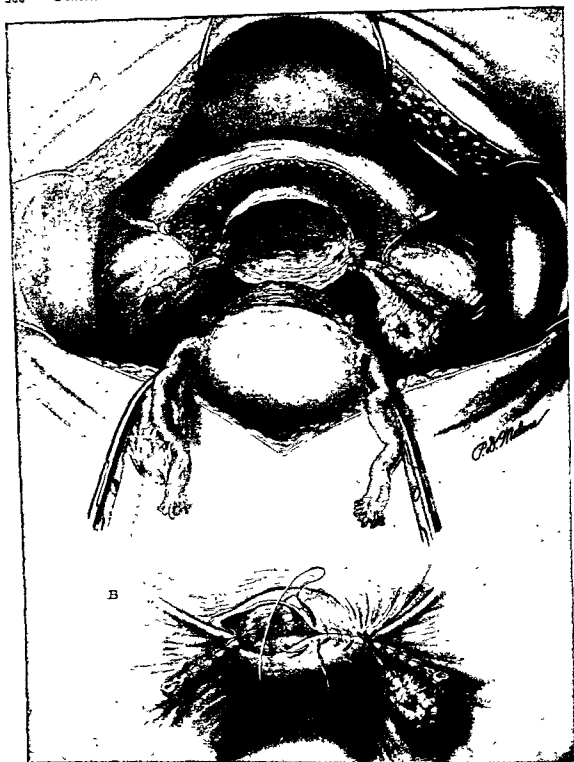


FIG. 305. Fundectomy with adnexectomy. (A) Tubes have been removed, and ascending uterine vessels have been tied. The fundus has been excised in a conical manner, after the bladder peritoneum has been cut and dissected downward. (B) The myometrium has been approximated with interrupted sutures of chromic catgut. The bladder peritoneum is being sutured to the peritoneum of the posterior side of the remaining portion of the uterus.

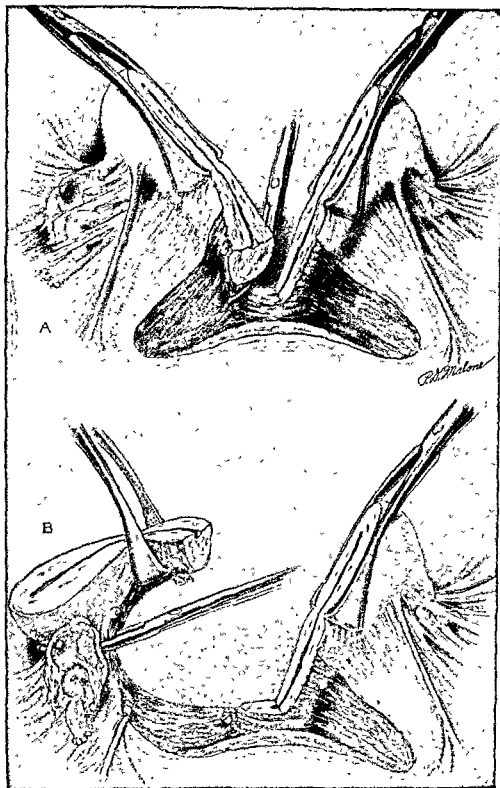


FIG. 306. Bisection operation. (A) The uterus has been bisected, and bleeding is controlled by grasping each half with vulsellum clamps. The right uterine vessel is being clamped. (B) Dissection has been carried laterally from below, and the infundibulopelvic ligament has been isolated and clamped.

slightly with a sponge on a sponge stick. Because of the extensive pelvic inflammatory disease, it may be impossible to do this. In such instances care must be exercised while performing the bisection to avoid injury to the bladder, which may be adherent high up on the anterior surface of the uterus.

An incision is made down through the

mid-line of the uterus until the level of supravaginal amputation is reached. Of necessity this may vary because of bladder adhesions. Bleeding from cut myometrium is controlled by grasping each half of the uterus with large volsellum clamps. Then the incision is turned laterally to amputate half of the corpus uteri from the cervix.

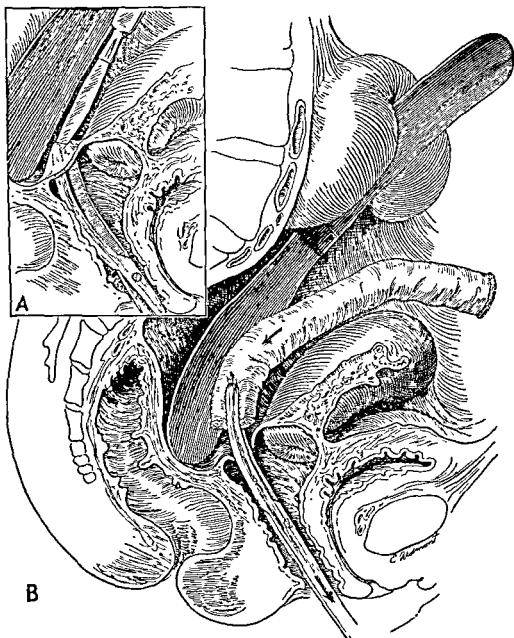
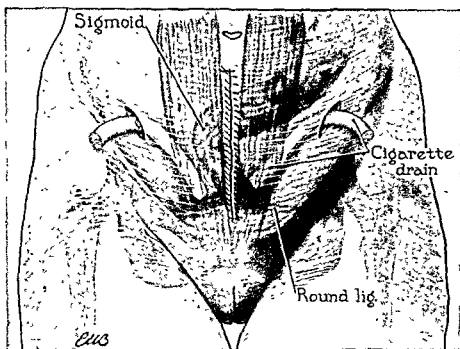


FIG. 307. Drainage of pelvis through cul-de-sac. (A) A long Kelly clamp is inserted into the vagina and opened slightly as the cul-de-sac is pushed upward. The scalpel incises between the jaws of the clamp. (B) Cigarette drain has been placed in the jaws of the clamp, and the clamp is withdrawn into vagina.

FIG. 308. Illustrating bilateral trans-abdominal drainage through stab wounds.



When the region of the uterine artery and veins is approached the vessels are clamped with a curved Ochsner clamp (Fig. 306 A). After opening the broad ligament in this manner the adnexal mass can usually be dissected free from its bed from below. The round ligament is clamped, cut and sutured as it is approached. Thus the infundibulopelvic ligament is isolated for clamping and cutting (Fig. 306 B). This operation is done only in the most severe cases of pelvic inflammatory disease when dissection of the adnexal mass cannot be done with safety from above. Therefore, it is rarely done when adnexa are to be conserved; hence, it is usually the infundibulopelvic ligament that is clamped, cut and sutured.

The same procedure is carried out on the opposite side. Then the suspension of the cervix and peritonization are carried out as after the usual subtotal hysterectomy. In this operation, as in the usual hysterectomy, the cardinal vessels are doubly ligated with No. 0 chromic catgut. Suture of the cervix is done with No. 0 or No. 1 chromic catgut, and peritonization is carried out with No. 000 chromic catgut.

#### DRAINAGE AT LAPAROTOMY FOR SALPINGITIS

Views on drainage at laparotomy for pelvic inflammatory disease have changed

markedly during the past several years. Whereas drainage was an everyday occurrence in gynecologic operating rooms of 2 decades ago, it is used only occasionally in our operating room today. Several factors are responsible for this change. Operations for acute and subacute pelvic inflammatory disease are avoided; hence, pus is encountered less frequently. Even where small pockets of pus are encountered, experience has shown that the pus may be wiped away and the abdomen closed with impunity without drainage. Antibiotic therapy has also reduced the indications for drainage. The operator is justified in depending on antibiotics to be administered postoperatively to combat the infection.

Practically the only occasions when the author uses drainage in laparotomy for salpingitis, aside from drainage of ruptured tubo-ovarian abscesses as discussed above, is when part of a necrotic abscess wall is, through necessity, left adherent in the pelvis or when the bowel has been entered accidentally and its closure has not been entirely satisfactory. When an abscess is found densely adherent to the bowel wall or the region of the ureter, a thorough removal of all of the wall might result in damage to a viscus. In such cases small portions of necrotic abscess wall should be left in situ and a cigarette drain placed against the area. The

ideal exit for such a cigarette drain is through the cul-de-sac as shown in Figure 307. Sometimes the cul-de-sac is completely obliterated by adhesions between the anterior rectal wall and the cervix. In such instances, the use of the posterior vaginal vault for drainage is not feasible. When drainage is indicated under such circumstances, it should be done through a small stab wound in either lower quadrant which is most directly above the point to be drained (Fig. 308). We dislike drainage through mid-line incisions because of the danger of hernia formation, and only resort to it there when it is imperative and the condition of the patient is so precarious that the abdomen must be closed in the quickest possible time. When the bowel has been entered accidentally and a perfectly satisfactory closure of healthy bowel wall effected, the abdomen is closed without drainage, and the patient is placed on streptomycin and penicillin. If the condition of the bowel wall is such that satisfactory closure cannot be done, a cigarette drain is placed down to the point of bowel injury and brought out through a stab wound.

#### RUPTURE OF OLD TUBO-OVARIAN ABSCESS

Special consideration should be given to ruptured *old* tubo-ovarian abscesses. Such abscesses may rupture as the result of bimanual examination or spontaneously. They are infected secondarily by organisms other than the gonococcus, and if treatment is not instituted promptly, the mortality is very high. The condition should be strictly differentiated from acute neisserian salpingitis. The acute or subacute tubo-ovarian abscess is often associated with local or generalized peritonitis of gonococcal origin. This type of acute infection usually yields promptly to antibiotics, and surgery is seldom necessary in this stage. In 26 cases of ruptured old tubo-ovarian abscesses on our service the cultures were reported as follows:

Streptococci . . . . .	6
Staphylococci . . . . .	4
Coliform groups . . . . .	4
Negative culture . . . . .	7
No report recorded . . . . .	5

It is difficult to evaluate the negative cultures of the purulent fluid. Possibly the swabs were dried out before being planted, for these patients with negative cultures were just as ill as the others. In no case was the gonococcus grown. Thus, the peritonitis resulting from the ruptured old tubo-ovarian abscess or pyosalpinx is an entirely different disease than an acute neisserian peritonitis and should be treated differently.

#### DIAGNOSIS

Age is important in this group of cases. In our series the average age was 33 years, which is at least 10 years later in life than the average age of the primary attack of pelvic inflammatory disease of the colored female population on our service. Often there is a history of recurring attacks of pelvic inflammatory disease, and during the recent exacerbation there has been a sudden increase in the severity and the extent of abdominal pain. Examination usually reveals a temperature of over 101° F. and a pulse rate of over 110. There are signs of generalized peritonitis with a pelvic mass. Shifting dullness and diminished or absent bowel sounds may be noted. The leukocyte count is likely to be over 15,000. A flat film of the abdomen may reveal dilated loops of small bowel with free fluid in the abdomen. Shock may be present or may develop while the patient is under observation.

#### TREATMENT

The treatment of these cases may be divided into 3 phases:

**Preoperative Phase After Rupture.** Operation should be undertaken after rapid but adequate preoperative preparation. The patient's blood should be grouped and cross-matched with 1,500 cc. of blood. The blood transfusion can usually be started as soon as available. Emergency blood chemistry determinations are obtained, and intravenous fluids are started immediately. Vigorous antibiotic therapy should be undertaken. Penicillin, streptomycin and intravenous oxytetracycline are used at this stage because they are given parenterally. An indwelling Foley catheter is helpful in controlling fluid balance. Generally, it is advantageous to pass

a Cantor or Miller-Abbott tube before operation. "Combat shock" is the watchword throughout treatment. It may be necessary when seeing the patient at a late stage to use plasma or a norepinephrine infusion.

**Operative Phase.** Blood transfusion should be started before surgery. The anesthetic of choice depends to some degree on the preference of the anesthetist, but in general we prefer cyclopropane with curare.

The operation should be carried out as rapidly as possible. Although time is not a very important factor in some surgery, it is when dealing with these patients. The patient should not be put in Trendelenburg position until the abdomen is packed, off and no more Trendelenburg position than necessary should be used, in order to prevent a dissemination of pus into the upper abdomen. The operation of choice is the removal of the free pus, together with the abscess, the uterus, the tubes and usually the ovaries. Rarely is it possible to leave some ovarian tissue. Even in the best surgical hands we believe that a subtotal hysterectomy is faster than a total and should be done in these patients. It is probable that the mortality would be increased if total hysterectomy were always done. Although we believe firmly in total hysterectomy, we do not believe that it should be persisted in when the danger of total hysterectomy exceeds the danger of leaving the cervix in.

*As a rule, it is much easier to remove the corpus in these cases than to attempt a unilateral adnexectomy. Furthermore, the opposite adnexa are almost always involved, and subsequent operation may be necessary if conservation of one side is practiced. If hemostasis is poor, or if considerable necrotic material is left behind, there may be some benefit from peritoneal drainage with cigarette drains through a stab wound or the cul-de-sac. In any event, after closure of the peritoneum and the fascia, a small gutta-percha wick should be put in the subcutaneous fat. The pus from the abdomen should*

be cultured, and the organism tested for sensitivity to the various antibiotics.

**Postoperative Phase.** In the postoperative care, one should consider shock, infection, ileus and fluid balance.

Shock should be combated with whole blood and, if necessary, norepinephrine intravenously. We occasionally have had to use an infusion of norepinephrine for many hours to combat shock. Infection is usually controlled by penicillin, streptomycin and intravenous oxytetracycline until the patient can take oral medication. The Fowler position may help prevent subdiaphragmatic abscess formation.

Constant suction by means of a Cantor or a Miller-Abbott tube is a very important feature of postoperative care. Adynamic ileus is often present and is best treated with the long tube.

Close attention to fluid balance and blood chemistry determinations is necessary. Not infrequently these patients have poor kidney function, and the fluid output and nonprotein nitrogen should be followed closely.

The results of the above therapeutic measures have been very gratifying. In earlier years medical treatment and simple drainage were the rule. Pedowitz and Felmus reported a mortality of 100 per cent in 1947 of the cases at Kings County treated by medical measures and occasional incision and drainage. Petroff reported 100 per cent mortality in the cases not operated upon and 66 per cent in the cases in which drainage only was carried out. Vermeeran and the author divided the cases in the Hopkin's clinic into 2 groups: those treated between 1925 and 1944 and those treated between 1945 and 1953. In the earlier group most of the cases were treated medically or by simple drainage. The mortality was 90 per cent. In the latter group treated by the method outlined above the mortality was reduced to 12 per cent. The deaths appeared to be due to severe shock from peritonitis and the accompanying severe paralytic ileus.



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# Abortions

## GENERAL CONSIDERATIONS

The importance of abortions as a cause of death and disease can only be estimated, but some idea of the immensity of the problem can be obtained by reviewing some of the available data. Naturally, statistics on abortions are inaccurate. The majority of abortions are done secretly and find their way into legitimate institutions only when serious complications arise. Some idea of the relative frequency of abortions to full-term confinements can be obtained from hospital records, because women are apt to be quite open about their previous abortions when giving obstetric and gynecologic histories. Taussig, whose investigations on the subject have been most exhaustive, reports an incidence of 371 abortions among 870 full-term confinements, a ratio of 1 abortion to 2.3 confinements. Dr. Kopp reports on an extensive study of 10,000 case histories from a New York clinic. She found a record of 11,172 abortions as compared with 27,813 confinements in a total of 38,985 pregnancies, a ratio of 1 abortion to 2.5 confinements. It is obvious that abortions are much more common in urban than in rural districts. Since much of this country is rural, it is necessary to get some idea of the frequency of abortion in country districts. The only available data on this phase of the subject come from Plass, who obtained his information from country practitioners throughout the state of Iowa. He reports an incidence of 1 abortion to 5 confinements.

From the above data Taussig, in 1936, estimated the total number of abortions in the United States to be 681,000. He based this on a population of 120,000,000 which was 42 per cent urban and 58 per cent rural. Today with a population of approximately 180,000,000 and a greater concentration in

the cities one could estimate approximately a million abortions annually. However, this can be little more than a guess, since so many abortions are never recorded. Nevertheless, a large proportion of the gynecologic admission on the ward service in cosmopolitan hospitals are for abortion. At the University of Pennsylvania Graduate Hospital, for example, there were 334 admissions, for abortion among 2,394 gynecologic admissions during the years of 1950 to 1957.

The death rate from abortions is equally difficult to determine with accuracy. If figures are taken from the hospitals, it ranges between 2 and 4 per cent. However, of the criminal abortions, only the complicated ones find their way into hospitals, so it is obvious that the percentage of hospital deaths is far greater than the mortality at large. Freudenberg arrived at a figure of 1.2 per cent after a very exhaustive study of abortions in Germany. Taussig considered this a fair estimate for this country. Assuming this figure to be approximately correct, and using the estimated figure of 880,000 annual abortions, the number of deaths for the year 1952 would be approximately 10,560. According to mortality statistics, there were 1,815 recorded deaths assignable to abortion in 1940. Obviously, this figure represents only a fraction of the actual deaths, and by no means would it make the estimated figure of 10,560 appear unreasonable.

Morbidity presents a much more important problem than mortality. It is impossible to estimate its incidence accurately. The number of women who suffer from chronic pelvic discomfort, sterility, ectopic pregnancy, surgical ablation of ovarian tissue and neuroses as a result of abortions is very many times the number who lose their lives as a result of abortion. Even when therapeutic

abortions were done under the best of conditions, as in the abortoria of Russia, there was an aftermath which made the authorities question the wisdom of legalizing them. The sequelae in a country where a large percentage of abortions is done illegally are undoubtedly much greater. However, the introduction of antibiotics, which are used freely by the more intelligent abortionists, probably has greatly reduced the mortality and the morbidity among their clientele.

### TERMINOLOGY

Abortion is the "*detachment or expulsion of the previable ovum.*" Although it is impossible to define accurately the term "previable," the lower limit of viability is usually taken as the 26th to the 28th week of fetal life.

It is not practical to attempt a single rigid classification of abortions, as various classifications differ, depending on the point of view. However, descriptive terms are used which should be clearly understood at the outset.

*Spontaneous abortion*, is, as the name signifies, one which occurs without outside initiation, either medical or instrumental.

*Induced abortion* is brought about by outside means. It may be *legitimately* induced therapeutically or *illegally* induced, in which case it is often spoken of as a criminal abortion.

A *complete abortion* is one in which the entire ovum is expelled spontaneously in 1 or 2 stages. An *incomplete abortion* is one in which a part of the fetus, the placenta or the decidua remains in the uterus. When uterine contractions and bleeding have begun, signifying beginning detachment of the ovum, the term *threatened abortion* is used. When, in the judgment of the physician, the detachment of the ovum has reached a stage where nothing can prevent its expulsion, the abortion is considered *inevitable*.

*Habitual abortions* are those occurring repeatedly in the same individual. Naturally, there may be some confusion as to exactly when a woman should be considered a habitual aborter. After 1 or 2 abortions the chances of going through a pregnancy are considerable, but after 3 abortions the ex-

pectancy falls very low; it has been estimated at 16 to 27 per cent. Hence, perhaps it would be well to limit the term "habitual abortion" to those cases in which there have been 3 or more consecutive abortions.

*Missed abortion* is a term applied to those cases in which the entire ovum is retained for some time after the death of the fetus. Litzenberg has arbitrarily placed a limit of 2 months after the death of the fetus as the borderline between abortion and missed abortion.

Any of the above types of abortion may become *infected*. The infection may remain within the confines of the uterus or spread into extra-uterine tissues.

### THERAPEUTIC ABORTION

#### LEGAL, MORAL AND MEDICAL CONSIDERATIONS

The termination of pregnancy before the 28th week for therapeutic reasons is a serious matter and deserves earnest consideration from legal, medical and technical points of view. Needless to say, there is wide diversity of opinion as to indications. There are moral and religious aspects to the problem, as well as a medical one, and these have colored men's views and influenced the laws.

Gynecologists should be familiar with the legal side of therapeutic abortion, for eventually every gynecologist is called upon to interrupt pregnancy, and he should be sure that he is acting within his legal rights. Federal laws are, of necessity, limited to interstate mailing, transportation and importation of literature, drugs and instruments which might be useful in preventing conception or producing abortion. Such laws—obviously antiquated—are generally disregarded in reference to contraceptive material. Strictly interpreted, the shipping across a state line of any gynecologic textbook in which the technic of interrupting pregnancy is described or the shipping of a curette or an ovum forceps would violate the law. The matter should be reconsidered, and new laws should be passed in accordance with the will of the majority of the governed people.

Guttmacher has brought the matter to the attention of the public in a popular journal, deploring the fact that present laws make

hypocrites out of doctors, patients, legislators and law-enforcement officers. He cites the more "modern" laws of the Scandinavian countries for consideration as models:

All these countries permit abortion for four general reasons: (1) for distinct medical reasons, when an existing disease which would be adversely affected by pregnancy poses a threat to the life or health of the mother; (2) for general health, including the socio-economic environment, too many children, or children too close together; (3) for eugenic reasons, the mental deficiency of parents or the probability that a congenital disease or malformation will be passed on to the unborn infant; and (4) for humanitarian reasons—a pregnancy resulting from rape or incest or the impregnation of a girl less than 15 years old.

Statutes are on the law books of all the states providing punishment for illegal abortion, but they vary widely. It is impossible here to give the laws of each state in detail and, indeed, if this were done, one would have great difficulty in interpreting them. Taussig, who made a detailed study of the state laws, grouped them into 5 general categories, according to the nature of exceptions permitted for performing abortions.

Group I. States in which there are no exemptions except such vague terms as "unlawfully," "feloniously" or "without lawful intent." (6 states.)

Group II. States in which an exception is made "to save the life of the mother," without mention of the medical profession. (Includes 31 states and 4 territories.)

Group III. States in which the exemption "to save life of the mother" is qualified by special mention of medical advice and intervention, implying that without it the procedure would not be justified. (7 states.)

Group IV. States in which the exemption to save the life or preserve the health of the mother is clearly dependent upon medical judgment, as the abortion must be performed by, or under the direction of, a physician. (3 states and the District of Columbia.)

Group V. States in which abortion is permitted whenever deemed necessary by a physician. (Mississippi.)\*

The Mississippi law is obviously the most liberal. There is no mention of agreement by

2 physicians and no mention as to who may do the procedure. The laws of Colorado, District of Columbia, Maryland and New Mexico are probably more in keeping with contemporary public opinion than those of the other states. They make exception when abortion is done to save the life or preserve the health of the mother, if medically advised. However, in all of these states it is not specifically stated that the abortion must be done by a qualified physician, which omission, in our opinion, is a grave error.

Taussig felt strongly that most of the state laws on abortion should be changed and, so far as possible, made more nearly uniform. He suggested the following essentials for such laws:

1. Primarily, consideration for the health of the mother and, secondarily, respect for the unborn fetus as a living organism, capable, if protected, of developing into an individual of value to the community.

2. Preservation of the best interests of the family as a whole, including the proper rearing of children already born.

3. Freedom from religious bias.

4. Punishment for those who seek financial gain from the practice of abortion.

In addition to these suggestions of Taussig, it would seem to us important to stipulate, specifically, that the abortion should be done by a qualified physician in consultation with another physician, and that it should be done in an institution licensed by state or local authorities to care for the sick, if such an institution is available in the community. The stipulation that the abortion be done in a reputable hospital would in itself make almost all of the abortions illegal which are done by professional abortionists for financial gains.

As to the general principles, medical and moral, which guide us in determining whether or not a woman should be aborted, there is a great difference of opinion in the medical profession. In general, the majority of practitioners lean toward the conservative side, but much of this conservatism may be the result of caution in complying with the state laws. There is no subject in all medicine where there is room for so much honest difference of opinion. It is doubtful whether any two practitioners would agree on all

\* Taussig, F. J.: *Abortion, Spontaneous and Induced*, St. Louis, Mosby, 1936.

indications for abortion, except those who are bound by ironclad rules of their religion. The difference in opinion is well illustrated by answers obtained by J. C. Ayres to a questionnaire that he sent out to 62 obstetricians living in the southern part of the United States. These replies have been tabulated, and here is the summary of the findings:

	Yes	No
For social reasons to prevent disgrace . . . . .	10	51
For economic reasons, poverty . . . . .	6	56
For health reasons (life not involved) . . . . .	22	37
To save mother's life . . . . .	61	1
In case of rape . . . . .	36	20
For dominant hereditary taint in both parents . . . . .	21	34

The difference in interpreting indications for therapeutic abortion among obstetricians of the highest rank is illustrated by statistics recently collected and published by Cosgrove and Carter. The striking thing about their statistics is that Cosgrove at the Margaret Hague Hospital is not only more conservative than his colleagues but hundreds of times as conservative. The ratio of abortions to live births at his clinic was 1:16,750. The next most conservative clinic had a ratio of 1:195 and from there the ratio rose to 1:35. However, no attempt was made to analyze the type of obstetric material cared for in the various clinics. It is evident that a clinic which selects pathologic material for teaching purposes would have a higher proportion of abortions than one which makes no selection. Cosgrove's criteria for abortion differ from those of the other obstetricians. It would be interesting to know what effect this ultraconservatism has had on his maternal mortality. Cosgrove pleads for greater conservatism in therapeutic abortion, but Kosmak points out that if all were as conservative as Cosgrove, the reduction of abortions in this country would be slight compared with the number done by professional abortionists for financial gain.

Cosgrove lists only 5 indications for which abortions have been done in his clinic: hyperemesis gravidarum, toxemia, fixed hypertension, heart disease and pulmonary tuberculosis. In a recent study at the New York

Lying-In Hospital by Kuder and Finn their listed indications are more in keeping with the views of obstetricians generally. They grouped 44 indications under 9 main headings:

	PERCENTAGE
Toxemia . . . . .	34.6
Cardiac . . . . .	23.6
Pulmonary disease . . . . .	11.1
Urologic disease . . . . .	9.6
Neuropsychiatry . . . . .	5.7
Medical diseases . . . . .	5.0
Obstetric complications . . . . .	3.6
Gynecologic complications . . . . .	3.6
Miscellaneous . . . . .	3.2
	<hr/> 100.0

It is not within the scope of this book to discuss in detail the indications for the therapeutic termination of pregnancy, but comments on the present-day views and trends are in order.

Hyperemesis gravidarum, for which many abortions have been done in the past, rarely necessitates the termination of pregnancy today. The patient can be kept hydrated and fed intravenously and supplied with vitamins parenterally so that almost never is it necessary to terminate the pregnancy. In some cases in which the psyche plays an important role, the psychiatrist may persuade the patient to cease vomiting.

The hypertensive type of toxemia constitutes the largest group requiring interruption. Since this type occurs most often in grand multiparae, the interruption is not as serious a calamity to the patient as when interruption becomes necessary in younger women with few or no children. It seems reasonable also to permit the multiparity to bolster the indications for abortions in this group. Severe preeclampsies and eclampsies usually occur late in pregnancy, and when interruption becomes necessary it often occurs after the fetus is viable.

If one adds to the hypertensive toxemia cases the urologic conditions necessitating abortion, the importance of cardio-vascular-renal disease becomes still more apparent. Complete urologic investigations as done today in the better gynecologic and obstetric clinics enable one to judge more accurately the necessity of terminating pregnancy. The

most common urologic condition for which pregnancy has been interrupted in the past is acute pyelonephritis. Sulfonamide and antibiotic therapy have almost done away with the necessity of interrupting pregnancy for this condition. In patients with only one kidney the interruption of pregnancy for urologic conditions should be considered much more liberally than when both kidneys are present. Chronic pyelonephritis still remains a legitimate cause for abortion, but the prompt use of chemotherapy and proper urologic treatment early in the course of the urinary-tract infection should greatly reduce the incidence of this disease.

Heart disease remains one of the more common causes for abortion, but there is much difference of opinion concerning it by obstetricians and internists. Cosgrove, for example, interrupts pregnancy only when there is actual heart failure. This seems to us to be an extreme point of view when one considers the high obstetric mortality with cardiac patients. However, one never should lose sight of the fact that these patients may be as poor surgical risks for abortion as they are poor obstetric risks. In view of this, it becomes apparent that it is essential to make the decision for or against abortion very early in the pregnancy, when the interruption can be done with little more shock than that of a diagnostic curettage. It would seem to us that multiparity should be taken into consideration in deciding whether one is justified in permitting a patient to take the greater risk of childbirth in the presence of heart disease.

The internist with considerable experience with obstetric patients is in a better position than the obstetrician or the gynecologist to recommend termination or continuation of pregnancy. Kornes states that

*Women with valvular disease, including mitral stenosis, often bear children surprisingly well, but in these cases the lesion must be minimal or the patient must have led a very sheltered life. In deciding which patients with valvular disease should go to term one must consider the age of the patient, how much cardiac hypertrophy there is, evidence of congestive heart failure, past or present, and the mechanism of the heart beat. The amount of ventricular hypertrophy is much more important than the valvular lesion.*

Kornes continues:

*Congestive heart failures which tend to progress in spite of treatment and are characterized by an increase in systemic or pulmonary venous pressure or both constitute a clean-cut indication for abortion. If the patient has had congestive failure in the past, permanent cardiac enlargement and enlargement of the liver, without hepatic pain or tenderness, pregnancy may be allowed to proceed under great precautions and observation. Some patients with the chronic nonprogressive form of heart failure, in which there is no increase in venous pressure and moderate edema is the principal manifestation, often tolerate pregnancy surprisingly well.*

Some of the disturbances in the mechanism of the heart beat are dynamically or symptomatically so serious that abortion is indicated. Among these are: acquired auriculoventricular heart block, bundle branch block, chronic paroxysmal auricular fibrillation, auricular flutter and ectopic tachycardia, particularly ventricular tachycardia. If the patient also has chronic valvular disease the indication often is urgent. Congenital A-V heart block or bundle branch block, if unaccompanied by other lesions, introduces no maternal risk at all.

Acute rheumatic heart disease or subacute bacterial endocarditis are imperative indications for abortion.

During the past decade there has been a definite swing to conservatism in the consideration of abortion in tuberculosis. Again, the most conservative attitude is illustrated by that of Cosgrove and Carter, who are convinced that "the tuberculous patient susceptible of arrest can stand pregnancy; she who will not arrest will not be seriously accelerated in her course of pregnancy." Although many obstetricians will not agree with this attitude, there is much evidence that pregnancy does not affect tuberculosis as adversely as was once believed. Multiparity, the care of the rest of the family and the ability to have the care of the baby taken over by someone other than the tuberculous mother must be considered in arriving at a just and proper decision. As in cardiac disease, there is no doubt that the decision should be made early in the course of the pregnancy, so that in case abortion is to be undertaken it should be done when it can be carried out with the least possible shock.

The commonest psychiatric condition for

which abortion is required is the manic-depressive syndrome. Since there are all degrees of this condition, it is impossible to make a sweeping statement regarding its relation to therapeutic abortion, except that in its more severe form it constitutes a legitimate cause. Schizophrenia more urgently indicates interruption. Gynecologists should be alert to the fact that psychiatrists differ widely in their feeling regarding the relation of minor psychoses to abortion. When the recommendation of the psychiatrist for termination of pregnancy seems too liberal the gynecologist, who must share in the responsibility of the abortion, should be privileged to ask for another psychiatric opinion.

The two most usual surgical conditions which occur during pregnancy, calling for consideration of abortion, are hyperthyroidism and breast carcinoma. Harvey believes that thyrotoxicosis should be treated in the pregnant woman as it would be were it not complicated by pregnancy, or rather as it would have been treated before the introduction of thiourea or thiouricil. He believes that the last reservation should be made until the results of further studies are available on the effect of these drugs on the fetus. To introduce abortion on a hyperthyroid patient is inviting trouble.

A decision regarding the termination of pregnancy in the presence of breast cancer can best be made by glancing at statistics presented by Harrington. Among 88 cases of breast carcinoma discovered during pregnancy and lactation, 85 per cent had extended beyond the breast, and 15 per cent had not. In the group with metastases only 5.5 per cent survived for 5 years, but in the group in which the lesion was limited to the breast the 5-year survival rate was 65.5 per cent. Thus it would appear that when the lesion has extended beyond the breast the chances of cure are so small that therapeutic abortion is not justifiable. Since the 65.5 per cent of 5-year salvage in the group in which the lesion is confined to the breast compares so favorably with the results in nonpregnant women, there would seem to be little reason for terminating a pregnancy.

In rare instances the termination of pregnancy is advisable for gynecologic and obstetric conditions. Myomata, because of their

size and position, may make the course of pregnancy dangerous; therefore, they may call for abortion. However, each case should be considered individually; age, parity and the general medical condition of the patient may be factors influencing the decision as to whether or not the patient should risk the pregnancy. Vesicovaginal and rectovaginal fistulas, repaired or unrepaired, seldom justify abortion, since elective cesarean section can be done to avoid further injury. A pregnancy in a uterus that has been transposed in the typical Watkins manner constitutes an absolute indication for abortion. A special point is made in mentioning the "typical" Watkins operation. The extraperitoneal operation as done by some operators is little more than the Manchester operation and is not incompatible with the progress of pregnancy. However, it is often impossible to be certain as to what type of "Watkins" operation has been done; if one is in doubt, no chance should be taken with continuing the pregnancy. Cancer of the cervix and cancer of the ovary discovered during early pregnancy should be treated without attempting to save the fetus, but when carcinoma of the cervix is discovered late in pregnancy, at times the pregnancy may be allowed to progress to the time of viability.

#### METHODS OF THERAPEUTIC ABORTION

Having concluded that the interruption of pregnancy is necessary, one must decide which is the best method in the particular case. There is often much justifiable controversy over this. The decision depends on several factors such as the duration of the pregnancy, parity, the condition for which the interruption is done, the condition of the patient at the time of interruption, the desirability of combining sterilization with abortion and the wisdom of doing other gynecologic surgery at the same time. In the following discussion it is assumed that the gynecologist concerned is capable of carrying out the best operative procedures. In case he is not, discretion may dictate the simplest method of performing the abortion, leaving elective surgery and sterilization to be done by an experienced gynecologist at a later date. Only two general methods need to be considered: irradiation and surgery.

### *Abortion by Irradiation*

Since 1907, when Fränkel first suggested the use of roentgen rays for the therapeutic termination of pregnancy, gynecologists, obstetricians, internists and roentgenologists have been interested in the subject. In 1925 Ganzoni and Widmer reported favorably on a small series of cases treated by this method. In 1930 these authors reported on 39 cases; in 36 of these the abortions were completed spontaneously with success. Two years later, Harris reported on 138 cases from the Mt. Sinai Hospital of New York, 129 of which were successful. In 1936 the experiences at that institution over a 10-year period were reported, with a clinical success in 96 per cent and an ideal success in 90 per cent. The authors claim that the method has no mortality and an exceedingly low morbidity. In spite of these and many other favorable reports in the literature the method never has become one of general use, and it would be well to consider at this time its advantages and disadvantages.

Irradiation as a method of abortion has obvious advantages when one is dealing with a seriously ill woman in whom any surgical procedure would be particularly disadvantageous or would be attended with great risk. Among such medical conditions should be mentioned severe deforming arthritis, severe cardiorenal disease, active pulmonary tuberculosis, toxic goiter, malignant growths and certain serious mental deficiencies. There can be no doubt that the avoidance of surgery is advantageous in diseases of these types. However, it must not be lost sight of that women who have been irradiated must still assume the risks of spontaneous abortion.

One of the greatest disadvantages of the use of the roentgen ray is the time that elapses between irradiation and actual abortion; the average period is about 4 weeks, but Harris reports as long an interval as 128 days, and Ganzoni and Widmer mention intervals up to 155 days. The mental torture of this waiting period and the uncertain ultimate result have an unfavorable psychic effect upon the mothers, and particularly upon those who are chronically ill. The method should not be used when the pregnancy is more than 14 weeks advanced and preferably should be used much earlier.

If irradiation is unsuccessful, under no circumstances should the pregnancy be permitted to go to term, because of the possible effect on the fetus. There is little doubt from reports in the literature that the chances that an irradiated fetus will become a defective child are too great ever to justify the child's birth. Opinion on the effect of irradiation upon subsequent offspring is not as definitely crystallized. E. Maurer reported on 14 children of previously irradiated mothers, all of whom were normal. However, of 229 such children which he found reported in the literature, 25 per cent showed some abnormality. However, he concluded in scrutinizing these cases that it is doubtful whether or not many of the abnormalities could justly be attributed to the previous irradiation. Nevertheless, the figure is far too high to be coincidental, and it is generally agreed that roentgen abortion is not justified in any woman in whom further childbearing is planned.

The effect of irradiation upon ovarian function is a serious disadvantage to roentgen-ray abortion, the importance of which is largely disregarded in the literature. Although it is possible to shield the ovaries partially, the likelihood of permanent amenorrhea is so great that the method is disadvantageous in young women. The usual dosage recommended for therapeutic abortion is 60 per cent of the erythema dose. Forty per cent of an erythema dose is sufficient to stop every woman from menstruating temporarily, and it effects permanent cessation in many patients over 40. Cases are reported in the literature in which therapeutic abortion has been accomplished by the usual 60 per cent erythema dosage, and menstruation has been resumed after a period of amenorrhea. However, the likelihood of permanent amenorrhea is so great that one can only proceed on the assumption that amenorrhea will be permanent. Indeed, if it is not permanent the possibility of future pregnancies arises. This is disadvantageous, because in most instances the contraindications to pregnancy still exist and, in addition, there is the possibility of a defective child.

In summary, we consider the roentgen method of abortion as an addition to our gynecologic armamentarium of limited use-



fulness. Its use is restricted to early pregnancy in the presence of serious disease in women who are to have no more pregnancies, and in whom there is serious objection to the surgical procedure necessary to terminate the pregnancy. The younger the woman, the stronger must be the contraindication to the surgery.

**Method.** The patient is given a cathartic the night before and an enema in the morning. A vaginal examination is made to ascertain the exact size and position of the uterus. Just before irradiation is begun the bladder is emptied by catheter.

The aim is to get 60 per cent of the erythema dose into the uterus. An anterior and posterior pelvic field will usually suffice for this. When there is great obesity, additional portals may be required. In the average case the suprapubic and sacral portals should be 15 x 20 cm. In the usual case, with an anteroposterior pelvic diameter of 20 cm., each opposing field should receive 600 r in air, provided that the apparatus will deliver 30 per cent S.E.D. at 10 cm. depth. The x-ray apparatus should be calibrated by a competent physicist. The physical factors are 180 to 200 K.V., 50 cm. F.S.D., filtered with 0.5 mm. copper and 1.0 mm. of aluminum. The treatment is given on 2 or 3 successive days.

Following the irradiation, pelvic examinations are done at weekly intervals to determine the size of the uterus. Pregnancy tests are of value, but in interpreting the results it should be remembered that sufficient chorionic tissue may live after the death of the fetus to give a positive test for several weeks. If bimanual examination indicates that the fetus is still growing after 4 weeks, further steps should be taken to terminate the pregnancy. If the pregnancy is at that time 16 weeks or less, further irradiation may be considered, but in most cases it is best to proceed with surgical termination if the mother's physical condition does not offer too serious a contraindication.

#### *Surgical Methods*

The surgical methods of termination of pregnancy therapeutically before the period of viability may be listed as follows:

1. Ordinary dilatation and curettage, uti-

lized only before the patient has missed her 2nd period.

2. Cervical dilatation with the Hanks or Hegar dilator and removal of products of conception with blunt curette and ovum forceps or sponge holder. This method is utilized up to the 12th week.

3. Preliminary gauze packing of the lower uterine segment and subsequent removal of products of conception by fingers and/or instruments. This method is utilized occasionally with patients from 12 to 14 weeks pregnant.

4. Hysterotomy, hysterectomy or fundectomy. These procedures are commonly used after 14 weeks, and in some instances before, when abortion is to be combined with sterilization.

5. Rupture of membranes, permitting the products of conception to be expelled spontaneously. It is the simplest method after the 4th month, but it is slow and uncertain. It is used more by obstetricians who are concerned with the later complications of pregnancy.

Before performing a therapeutic abortion it is wise to give penicillin, beginning approximately 24 hours before the operation: 300,000 units given twice on the day preceding the operation and the same dosage on the morning of the operation is adequate; 300,000 units twice daily for 3 days after the surgery is a wise precaution. If the patient should be febrile after 3 days, the antibiotic therapy is continued.

The method of choice is dilatation and curettage done with the usual Hegar or Hanks dilators and the ordinary small serrated curette if the pregnancy is interrupted before 6 weeks (before missing the 2nd period). If done with careful aseptic technic it is almost as safe a procedure as the ordinary diagnostic curettage on the nonpregnant uterus. When the pregnancy has progressed beyond this time the dangers attending cervical dilatation and instrumental emptying of the uterus are increased. For the first 12 weeks of pregnancy dilatation of the cervix with metal dilators is to be preferred to preliminary gauze packing. Although laminaria tents are used by many gynecologists in Europe, we do not use them because of the difficulty of sterilization and because of the

objection of leaving a foreign object for several hours in the tract through which the uterine cavity must be entered. There is also the objection that the tent may slip down and fail to dilate the internal os, or slip up into the uterus.

In dilating the cervical canal preliminary to emptying the uterine cavity, sterile technic must be carried out meticulously. The vagina must be cleansed and sterilized with special care, and the cervical canal should be cleansed with alcohol swabs. Another precaution, which is important when the cervical canal of the pregnant uterus is to be dilated, is to examine the patient carefully under anesthesia to learn the exact position of the uterus. Perforation of the soft uterus with the dilators is easily done if the operator persists in forcing the dilator in a direction other than that of the cervical canal. Dilatation should be carried to a sufficient degree

to permit the free use of the necessary instruments in the uterine cavity and the removal of the products of conception. During the first 6 weeks of pregnancy dilatation to 1 cm. or slightly more is all that is necessary, but at the end of the 3rd month dilatation to 2 cm. is sometimes required. When the dilator is introduced one must guard against permitting it to slip suddenly with great force past the resistant internal os. The Hanks dilators have ridges to prevent introduction beyond a certain point, but the Hegar dilator can be used with equal safety if the operator has this precaution in mind, as he should at all times when working on the pregnant uterus (Fig. 309).

When the pregnancy has advanced beyond the 12th week we are apt to empty the uterus by hysterotomy but occasionally, especially in parous women, emptying it through the cervix seems to be advisable.

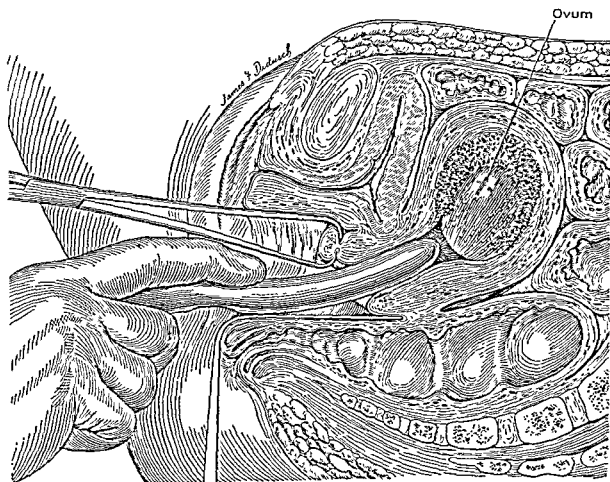


FIG. 309. The cervix is dilated with a Hegar dilator.

In such cases cervical dilatation by preliminary gauze packing may be safer and more satisfactory than dilatation with metal dilators. To one who is surgically minded the idea of packing the lower uterine segment with gauze and then entering the uterine cavity a day later is repellent. However, this method is used by a great many professional abortionists who have a remarkably low incidence of clinical infection, and it is safer than forcing rapid dilatation with metal dilators when pregnancy has advanced beyond the 12th week.

The method of emptying the uterus after the cervix has been dilated depends chiefly on the duration of the pregnancy. As stated above, during the very early weeks of preg-

nancy the ordinary small serrated curette is effective and safe. In these early cases a little more than the usual care must be exerted in using the small curette if the uterus shows appreciable softening. Also, care should be taken to curette the entire cavity completely, for it is possible to miss an early ovum in spite of a reasonably thorough curettage. Later, up to the 14th week, the ovum forceps, the sponge holder and the large blunt curette are the best instruments for removing the products of conception. An injection of pituitrin just before curettage is a worth-while precaution. The large blunt curette is introduced, and the uterine cavity is curetted gently (Fig. 310). One can usually get an idea of the force with which one

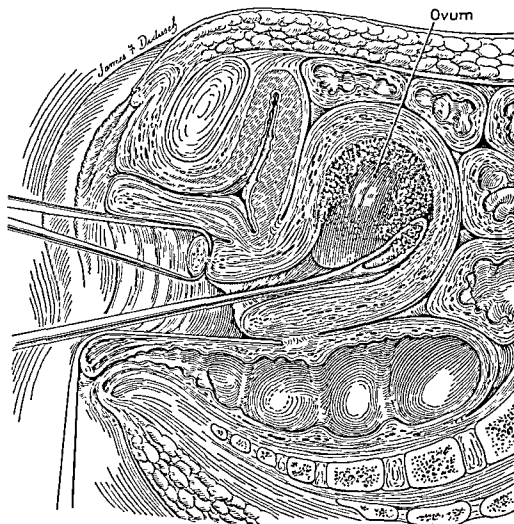


FIG. 310. The ovum is detached from the uterine wall with a blunt curette.

may safely curette by the consistency of the uterus noted on bimanual examination and by the sensation imparted through the curette as the uterine wall is stroked. Often little tissue comes away with the curette, but the products of conception are loosened, and the ovum forceps is then used to remove them. It is best not to attempt to tear the ovum from the sides of the cavity with the ovum forceps, for it is possible in attempting this to tear away pieces of the myometrium and even perforate the uterus (Fig 311). In some instances when the pregnancy is not far advanced the regular ovum forceps may be too large to pass easily through the internal os and be manipulated

readily. Then the ordinary sponge holder may be found to be a most useful instrument for removing the embryo and the membranes. One of the greatest difficulties in performing a therapeutic abortion is to determine when the operation has been completed. When the operator feels that he has removed all the products of conception completely by the above maneuvers, a sponge holder is wrapped with a dry gauze sponge as shown in Figure 312, and the walls of the uterine cavity are rubbed with it. Often particles of placental tissue will be found adherent to it.

Often after the 12th week, loosening of the membranes can be done best with 1 or 2 fingers introduced through the widely di-

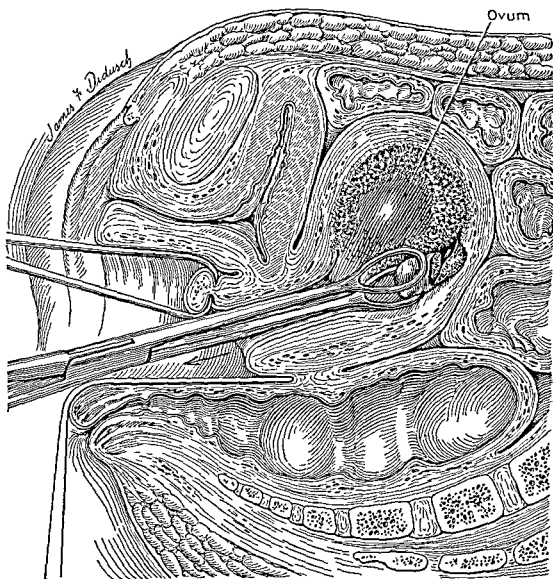


FIG. 311. A piece of myometrium is torn away with the instrument.

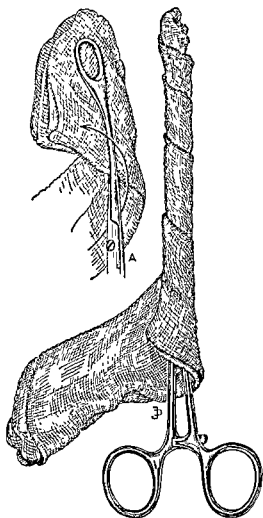


FIG. 312. A curved sponge holder covered with gauze is an excellent and soft instrument for freeing placental remnants from uterine wall.

lated cervix. Removal of the products of conception is usually not very successful with 1 or even 2 fingers, but after loosening these products digitally they can be removed readily with the ovum forceps or the sponge holder.

The question of packing the uterine cavity arises after its instrumental emptying. There are only two reasons for considering it: the control of hemorrhage and the removal of particles of membrane or fetus that have not come away with the instruments. In our experience, packing is seldom necessary for the control of hemorrhage. As soon as the

operator believes that he has completed the operation an ampule of pituitrin is given, preferably into the anterior wall of the cervix. Then the os is observed for several minutes to note the amount of blood coming from it. If the bleeding does not seem to be under control after giving the pituitrin ample time to act, the uterine cavity is packed tightly with a gauze strip from 1 to 3 inches in diameter, depending on the size of the uterine cavity. Before being inserted, the pack is moistened with salt solution and sprinkled with 5 Gm. of sulfanilamide powder. It is removed at the end of 24 hours. Occasionally, in spite of every effort, it is apparent that the entire fetus and membranes have not been removed instrumentally. Then, also, a sulfanilamide pack is placed in the uterus. When it is removed after 24 hours the remaining particles of the products of conception will often be adherent to the pack or will be passed shortly after its removal.

After a therapeutic abortion the patient is kept in bed from 4 to 7 days. The shorter the duration of the pregnancy, the shorter the period of bed rest. Even when the pregnancy is only of a few weeks' duration, the operation should not be considered as lightly as an ordinary diagnostic curettage. Some danger of infection is ever present, even when the greatest aseptic care is exercised.

Occasionally persistent or profuse bleeding indicates that evacuation of the uterus has not been complete, and one is confronted with the possible necessity of further intra-uterine instrumentation. *The second entrance of the uterine cavity is attended with much greater danger than the first.* It is in performing abortions on patients who have been attempting to abort themselves that criminal abortionists most often get into difficulties. The slight infection introduced at the first attempt is usually well walled off, but the breaking down of the leukocytic wall by the second instrumentation permits millions of organisms to enter the lymphatics and the blood stream. Even when the temperature is normal, one must assume that some infection exists in the uterine cavity for several days following an abortion done under the best of aseptic conditions. Therefore, one should postpone as long as possible a second attempt to empty the uterus completely. Hem-

orrhage is the symptom that eventually may force a second operation, but by repeated transfusions one is often able to keep up the hemoglobin and avoid, or at least defer, entering the uterine cavity again. When the second operation becomes unavoidable, the patient is thoroughly treated prophylactically with a chemotherapeutic agent for 24 hours before the operation is done, unless extreme hemorrhage does not allow this much time. In that case chemotherapy is instituted immediately after operation.

The termination of pregnancy after the 12th week is usually best done by hysterotomy, hysterectomy or fundectomy until much later in pregnancy when, in certain cases, rupture of membranes is a satisfactory method.

Sterilization is often indicated when therapeutic abortion is done, and this may alter the procedure by which the pregnancy is best terminated. It is impossible to lay down absolute rules regarding the method of performing the abortion and the sterilization; each case should be decided on its own merit. The stage of the pregnancy, the presence of intrapelvic pathologic lesions, the parity of the patient, the condition of the vaginal outlet and the general condition of the patient make each case an individual problem. As a rule, pregnancy, which requires termination at 6 to 12 weeks in a woman who should be sterilized, should be terminated according to the rules considered earlier in this chapter without regard to the sterilization. Then tubal sterilization may be done at the same time or later. After the 12th week an abdominal hysterotomy and tubal sterilization may be done, but fundectomy, removing the products of conception with the fundus and at the same time sterilizing the patient, has proved to be a simple and effective means of attaining the abortion and sterilization.

Whenever laparotomy is to be done for termination of pregnancy and sterilization, the matter should be discussed with the patient. Although saving the uterus in a sterile woman would not appear to be important, the preservation of the menstrual function may be excessively important in the minds of some women. The medical condition of the patient may dictate the shortest possible

procedure, which for many operators would be hysterotomy and tubal sterilization. However, we have found fundectomy to be remarkably simple and satisfactory. Sufficient uterus is preserved to permit menstruation, and yet by fundectomy, the possibility of future disease of the uterine corpus is almost eliminated. The procedure is shown in Figure 314. Fibroids in the pregnant uterus may make hysterectomy the desirable method of accomplishing the desired ends. When hysterectomy is done, the total operation is preferable and usually can be carried out quite as simply as on the nonpregnant women. However, it should be borne in mind that these patients are not robust, and total hysterectomy should not be persisted in if the risk of added operating time outweighs the advantages of removing the cervix.

Methods of tubal ligation are discussed on page 636. Although we generally prefer cornual resection of the tube on the nonpregnant uterus, it is contraindicated during pregnancy, except in the extremely early cases. The increased vascularity at the uterine cornu in the pregnant uterus and the softness of the myometrium make the operation bloody. In most cases, an operation of the Pomeroy type is best suited and is quickly done without blood loss.

We have not practiced vaginal hysterotomy for termination of pregnancy. In those cases in which the pregnancy has advanced to the stage where some gynecologists would perform vaginal hysterotomy, we believe abdominal hysterotomy or fundectomy is done more easily and safely.

**Technic: Abdominal Hysterotomy for Termination of Pregnancy.** A low mid-line incision is made as for the usual pelvic laparotomy. If the pregnancy is early, the uterus is delivered out of the abdomen. If it is advanced, the operation may be done without delivering the uterus. It is not justifiable to enlarge the incision sufficiently to deliver a greatly enlarged uterus. Moist gauze packs are used to keep the blood from running into the abdominal cavity.

An incision is made through the anterior uterine musculature, entering the uterine cavity. In order to elevate the anterior wall and steady the uterus a traction suture of catgut is placed at either end of the incision (Fig.

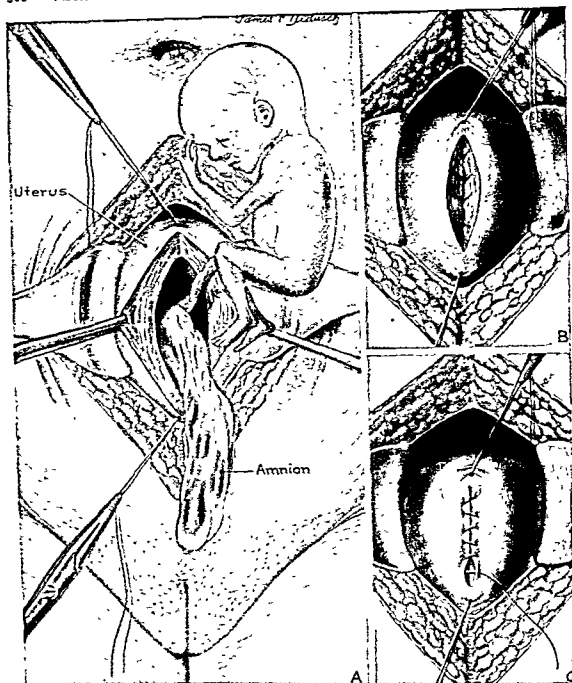


FIG. 313. Abdominal hysterectomy for therapeutic abortion (A) The uterus has been opened, and the fetus has been delivered. (B) The myometrium has been sutured with interrupted sutures. (C) The serosa is approximated with continuous suture of fine catgut.

313). An attempt is made to shell out the complete sac intact from the uterine cavity. In the more advanced pregnancies often this is not accomplished. The fetus and the rup-

tured amnion are delivered, and then the placental tissue (Fig. 313 A). An ampule of pituitrin is then given into the uterine musculature.

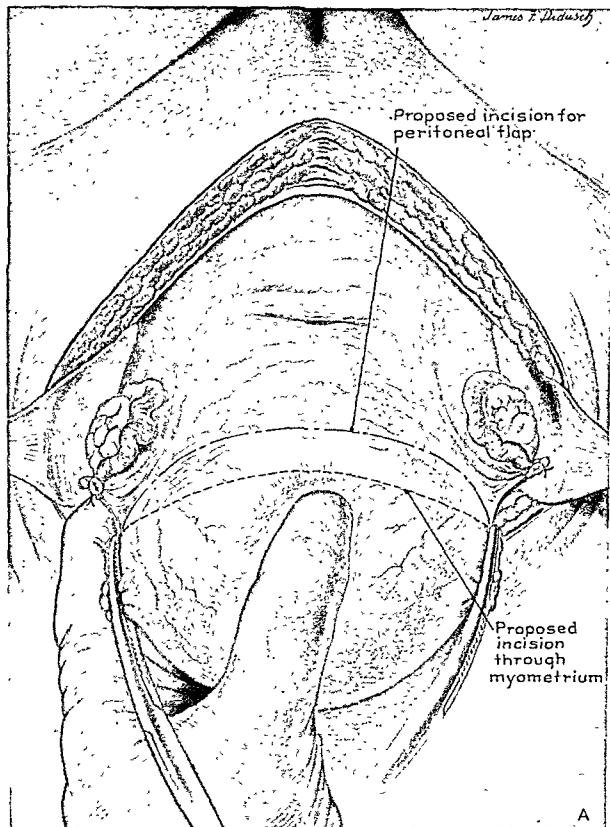


FIG. 314. Fundectomy for abortion and sterilization. (A) The uterus is grasped in the hand. Products of conception are squeezed upward. Proposed incisions of peritoneum and myometrium are indicated.



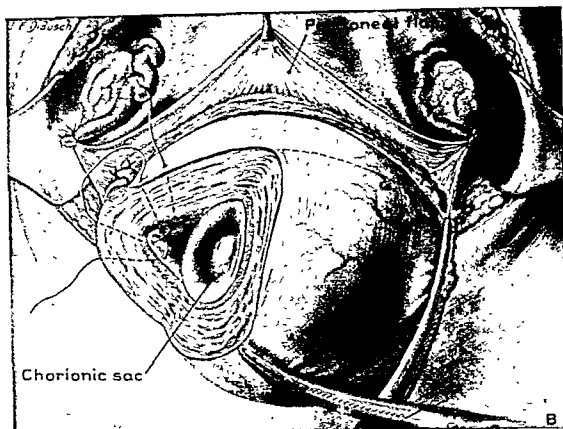


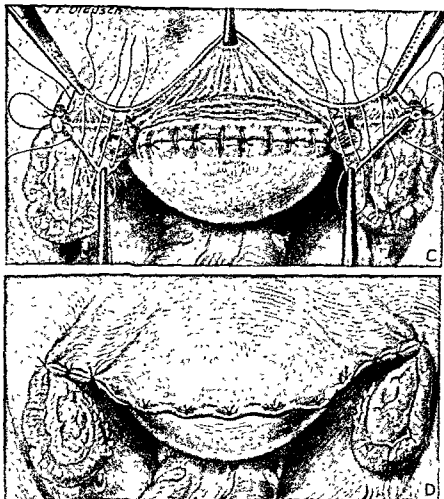
FIG. 314 (Continued). Fundectomy for abortion and sterilization. (B) The peritoneal flap has been dissected down. The myometrium has been incised and is being closed with figure-of-eight sutures as incision is made to control hemorrhage.

Closure of the uterine incision is done in 2 or 3 layers. The musculature is first approximated with interrupted or figure-of-eight sutures of No. 0 chromic catgut which do not enter the uterine cavity (Fig. 313 B). The second layer closes the serosa and the superficial musculature with a continuous Cushing stitch of No. 0 chromic catgut (Fig. 313 C).

**Technic: Fundectomy for Termination of Pregnancy and for Sterilization.** The upper portion of each broad ligament, including the round ligament, the uterine end of the tube and the ovarian ligament, is doubly clamped and cut between the clamps. The ligaments are doubly ligated with No. 0 chromic catgut, but the clamps are left on the uterine side. Grasping the uterus in the left hand, the products of conception are squeezed up to the fundus. In this way the operator can determine at what level to make

the incision into the myometrium. The usual level is indicated by the dotted line shown in Figure 314 A. The peritoneal attachment is then cut as it is reflected onto the anterior surface of the uterus. This is usually about  $\frac{1}{2}$  inch below the proposed incision into the myometrium (Fig. 314 A). After dissecting the bladder peritoneum downward sufficiently to mobilize it for covering the stump, the ascending branch of the uterine artery and the accompanying veins are clamped just below the proposed level of amputation. The vessels are doubly tied with No. 0 catgut as shown in Figure 314 B. The amputation is begun, making the anterior and the posterior incisions to converge in a slightly V-shaped manner to facilitate closure. Closure of the lower portion is carried out by figure-of-eight sutures of No. 0 catgut as the incision is made (Fig. 314 B). Thus bleeding is controlled as the incision is continued, and there

FIG. 314 (*Continued*). Fundectomy for abortion and sterilization. (C) The fundus has been removed, and the stump is sutured. The ends of the tubes are about to be buried between leaves of broad ligaments (D) Peritonization has been completed.



is a minimum of blood loss. Unless there is a very low implantation the products of conception are removed cleanly and completely as shown in Figure 314 B. There is usually less blood loss than with abortion by hysterotomy, and there is no possibility of leaving any placental tissue. After complete closure of the stump with figure-of-eight sutures, as shown in Figure 314 C, the stump is peritonized with No. 000 chromic catgut as shown in Figure 314 D. The ends of the tube are buried between the leaves of the broad ligament as the peritonization is completed.

#### MANAGEMENT OF HABITUAL AND THREATENED ABORTION

Habitual and threatened abortion are considered together, since they are probably closely related etiologically and have been grouped together therapeutically. After having ruled out occasional organic causes, such

as myomata and marked retrodisplacement, there is an almost complete lack of understanding of the underlying causes. Hence, there is the widest divergence of opinion as to therapy. All are agreed on the benefits of rest in bed with threatened abortion, but there is great disagreement on all other therapeutic measures. With habitual abortion there is even disagreement as to the benefits of bed rest. There is also divergence of opinion as to sedatives when abortion is threatened; some obstetricians use opium alkaloids, and others prefer barbiturates.

From one point of view there is grave doubt whether it is possible to accomplish anything by any type of treatment, since some evidence exists that in a large percentage of the cases the ovum is defective and incompatible with continuing pregnancy. If this is true, the clinical picture represents the terminal phase of an irreversible process. This conception which has been championed

recently by Hertig is not a new one, for it was first expounded by Mall in 1917. Recently, Hertig has shown that, according to his interpretation, 70 per cent of abortions are the result of developmental defects in the ovum or its appendages. In 17 per cent more, Hertig found that the abortions were due to unavoidable maternal conditions. This leaves only 13 per cent in which the abortion might have been prevented. If we accept in toto these data, it is most comforting to both the parents and the physician, for it may be assumed that if the defective embryos are not cast off early in pregnancy they may develop into grossly deformed babies. However, it is not very stimulating to investigators to feel that in only 13 per cent is there the possibility of saving a normal embryo. There is also the thought to be reckoned with that if one should be successful in preventing an abortion, one might, on occasion, induce an abnormal fetus to go to term. However, before accepting these data and conclusions in full one should seriously consider whether or not some of the slight abnormalities described by these histopathologists are of the grave significance which they believe them to be.

The relation of the hormones to abortion is poorly understood, and there is little conclusive data. The role of the corpus luteum in early pregnancy was proved by the classic experiments of Frankel in 1903. He showed that if the corpora lutea of rabbits were destroyed by the cautery after copulation, but before the 6th day, pregnancy failed to occur. If the corpora lutea were destroyed after the 6th day, i.e., after the implantation of the ovum in the endometrium, abortion invariably took place. He thus established the role of the corpus luteum in the process of implantation of the fertilized ovum and in the maintenance of early pregnancy. That the corpus luteum is as essential to the maintenance of early pregnancy in the human has been shown repeatedly, for when the removal of the corpus luteum of pregnancy becomes a necessary surgical procedure in the first 3 months of pregnancy, abortion almost invariably follows shortly afterward. Some of the early work on the relation of corpus luteum function to abortion was done by J. S. L. Browne, J. S. Henry and Eleanor

Venning. They attempted to judge corpus luteum function during pregnancy by determining the amount of sodium pregnanediol glycuronide excreted. It is assumed that this is the excretion product of progesterone, since it is not present in the urine during the follicular phase of the menstrual cycle but makes its appearance from 24 to 36 hours after ovulation. It remains present in the urine for 10 to 12 days, while histologically the corpus luteum appears to be active. In case of pregnancy, a chorionic gonadotropin appears in the urine almost immediately on implantation, as it is the secretion of the chorion. The chorionic gonadotropin usually maintains the corpus luteum function at the same level or slightly higher than the maximum attained during the menstrual cycle. In the normal pregnancy, pregnanediol excretion rises from this level as early as the 70th day, but in some cases the rise fails to occur until the 100th day. This rise is thought by Browne *et al.* to be due to the secretion of progesterone by the placenta. As the corpus luteum degenerates with the progress of pregnancy, there is a transfer of the function of progesterone secretion from the corpus luteum to the chorion. This theoretically explains the almost certain abortion that follows surgical removal of the corpus luteum during the first 3 months of pregnancy and the probability of no abortion's occurring when the corpus luteum is removed later. It also offers a theoretical explanation for abortion when the corpus luteum ceases to produce progesterone before its production is established by the placenta. The common occurrence of abortion at 2½ to 3 months might be explained by this theory. Henry, for example, found in a study of 500 abortions that the average time of the onset was the 81st day.

This theory, then, is the basis for the treatment of abortion by progesterone. It is generally believed that progesterone has a quieting influence on uterine muscle contractions in the pregnant uterus, although some doubt has been cast on this by Kurzrok. Nevertheless, progesterone is given with the hope of inhibiting uterine contractions and perhaps, early in pregnancy, to reinforce the progesterone effect on the decidua.

As reports appear in the literature on pro-

gestosterone therapy it is obvious that obstetricians fall into three groups. Greenhill has classified them as follows:

One group is most enthusiastic about the results obtained with progesterone and considers it a specific for the aforementioned conditions. A second group considers progesterone worthless and occasionally harmful. The third group does not know whether progesterone has any value or not, but continue to use it in the hope that it will do some good.

On searching the literature it is extremely difficult to draw conclusions as to the effect of progesterone therapy. Many of the results are uncontrolled and, after all, one never can be certain whether or not a threatened abortion would have gone to term if untreated. Falls and his co-workers are, perhaps, the most enthusiastic about their results. They found that most of the active extracts of corpus luteum obtained on the open market contained a hormone that inhibited contractions of the human uterus, which had been stimulated by injection of posterior pituitary extracts. They found that purified progesterone, which produces progesterational changes in the rabbit's endometrium, had little inhibiting effect on uterine muscle contractions. Contrary to the belief of most experimenters, Falls and his co-workers were able to stop uterine contractions with aqueous preparations.

Hamblen is inclined to be much more guarded in his conclusions. He comments on the facts that patients often abort with pregnanediol levels which are not much depressed, and that patients with low pregnanediol levels often abort in spite of intensive progesterone therapy and without showing any elevation of these levels of excretion. For habitual aborters Hamblen gives weekly doses of progesterone, ranging from 15 to 140 mg. administered daily or every other day by intramuscular injection. Anhydroprogesterone was given orally 3 times a day, the total daily dose ranging from 20 to 60 mg.

In the past 15 years many obstetricians have presented evidence that the administration of vitamin E may enable women who have had repeated abortions to give birth to living children. In spite of these reports, the status of vitamin E therapy is in the

same state of confusion as progesterone therapy. No accurate data on vitamin E in normal pregnant women is available, nor has there been any demonstration of actual deficiency in patients who abort. The report of the Council on Pharmacy and Chemistry in 1940 includes a series of 175 cases of habitual abortion collected from the literature, with 132 successful results. The daily dose of wheat germ oil used by different authors varied between 0.25 and 6 cc. In spite of this, the various authors all claimed equally good results. One should bear in mind the fact pointed out by Paine that if vitamin E deficiency plays a part in producing abortion, why do we not see spontaneous abortions oftener in women who have severe persistent nausea and vomiting and hence a real deficiency in vitamin E intake? The critical reviewer for the Council on Pharmacy and Chemistry sums up the results as follows:

The claim that vitamin E is of value in the prevention of habitual abortion cannot be accepted because of the lack of convincing clinical evidence. The diagnosis of habitual abortion in many of the published reports is open to question; the great variation in dosage of vitamin E and the lack of evidence that the preparations used were active make it difficult to attribute any effects claimed for it to the vitamin. Moreover, the expectancy of spontaneous cure in cases of so-called habitual abortion has not been accurately established.\*

During the past 2 decades, thyroid extract probably has been used in the treatment of habitual abortions more than any other drug. Among the earlier and more enthusiastic workers in the field were Litzenberg and Carey, who believe that hypothyroidism is a common cause of sterility and repeated abortion. They reported that of 78 married women with a low basal rate, 35 were absolutely sterile, 6 had also had one or more abortions or stillbirths. They classified obstetric patients with a basal metabolic rate of  $-10$  or below as hypothyroid. More recently, King and Herring found 61 of 150 women in early pregnancy to have hypothyroidism. Most obstetricians give thyroid ex-

\* The treatment of habitual abortion with vitamin E. Reports of the Council on Pharmacy and Chemistry, J.A.M.A. 114:2214, 1940.

tract when the basal rate is low; many give it empirically for sterility, threatened and habitual abortions, but the exact role of thyroid function to abortion has not been determined.

#### METHOD OF JONES AND DELFS IN MANAGEMENT OF HABITUAL ABORTION

After reading the above evaluation of present-day opinions regarding therapy one is left with a feeling of confusion as to the proper method of handling aborters, and especially habitual aborters. Jones and Delfs have attempted to bring order out of chaos by making thorough studies on a series of pregnancies occurring in habitual aborters. In 43 such pregnancies they found low thyroid function in 31 of their cases, low pregnandiol excretion in 12, low vitamin E in 7, low gonadotropin in 6, a bicornuate uterus in 2 and no demonstrable deficiency in 7. They directed their therapy at correction of deficiencies, and those patients showing no deficiency were not treated. Six of these 7 patients went to term. The plan of management as suggested by Jones and Delfs as carried out in our clinic is as follows:

**Early Investigation.** The patient with a history of repeated abortion should have a thorough study before another pregnancy is undertaken. General examination should be carried out with correction of any factors such as infection or anemia. Weight and nutritional status should be evaluated. Many of these women show slight to moderate obesity, and an occasional one is underweight. Dietary measures should be directed toward an ideal weight. All patients with reproductive difficulties should have a high-protein, high-vitamin diet with adjustment of total calories to favor loss or gain as the situation indicates. Inquiry should be made into the habits of the patient. Excessive fatigue, insufficient sleep, nervous tension due to overwork or social activities, should be corrected. Immoderate drinking and smoking should be eliminated, particularly as the latter often interferes with good nutrition. If the husband's semen examination shows abnormalities, a similar dietary and hygienic regime should be instituted for him.

**Thyroid.** Litzenberg pointed out the importance of the thyroid in reproduction many years ago, but recently it has been overshadowed by the newer and more popular

steroid hormones. The occurrence of thyroid deficiency in *72 per cent of the pregnancies* in the series of Jones and Delfs re-emphasizes this factor as of first importance.

Basal metabolism, blood cholesterol and protein-bound iodine determinations should be carried out before pregnancy is begun. Treatment may be considered indicated if the cholesterol is over 225 mg. per cent, the basal metabolism below zero or the protein-bound iodine less than 4.5. It is recognized that the metabolic rate less than zero varies from the usual allowance of -10 for the lower limit of normal and therefore includes some patients who may be low normals. This is justifiable therapy in individuals who give a history of abortions, as there is some evidence that reproductive difficulty may be the most sensitive indicator of thyroid deficiency and may be manifest long before other clinical signs. Most of these patients never develop symptoms and signs of definite myxedema.

Dosage of thyroid should be adjusted to the need, but large amounts are rarely required. *Most patients respond well in the range of ½ grain to 2 grains daily.* Thyroid treatment should be maintained three to four months before pregnancy is attempted. This point of treatment with thyroid some months before pregnancy has been overlooked frequently and may account for some disappointments in its use. It should be continued throughout pregnancy, though reduction in dosage may be necessary occasionally in the last trimester.

**Progesterone.** The many published reports on the use of progesterone in habitual abortion are contradictory. The data on Jones and Delfs series suggest that deficiency of progesterone alone is rare. Even when associated with other deficiencies *only 17 per cent* of the successfully treated series had any indication for progesterone therapy. Of the cases ending in abortion 7 (50 per cent) showed low pregnandiol, but over half of these were not salvageable as they had defective pregnancies when first seen. Progesterone is desirable for the cases which are deficient but it alone cannot be expected to benefit the larger number which have no deficiency. However, where facilities for pregnandiol determinations are lacking, progesterone therapy may be given with no harm and occasional benefit.

The most logical use of progesterone in habitual abortion, where trouble may be anticipated, would seem to be prophylactic treatment in the premenstrual period and through the early weeks of pregnancy as suggested by Rutherford. This aids in building up and main-

taining a succulent progesterational endometrium during the critical stage of implantation and rapid early stage of development. We have used "progesterol" or one of the other oral preparations of pregnenolone in preference to progesterone because it permits continuous therapy without the fluctuation involved in intermittent injections. Increased convenience to patient and physician is obvious. Satisfactory dosage is 30 mg. daily divided into three doses beginning 7 to 10 days before the expected menstrual period. If the menstrual period occurs, indicating that pregnancy is not present, medication is discontinued until the latter part of the next cycle. If pregnancy occurs, "progesterol" is continued in the same dosage until it is evident from pregnandiol determinations that ample progesterone is being produced. When pregnandiol determinations are not available, the dosage usually may be tapered off in the fourth or fifth month, though there is no objection except expense to carry it on to the last month.

**Estrogen and Vitamin E.** In the latest edition of this book consideration was given to estrogen and vitamin E therapy in habitual abortions. The uselessness of estrogen in preventing abortions has been very well shown by the work of Ferguson and also that of Dickman *et al.* Since the publication of these two important papers most obstetricians have given up its use. The same can be said of vitamin E, which was in vogue a decade ago but has not proved to be of value.

In the small group of late abortions in which well-formed fetuses are lost in the 2nd trimester, progesterone deficiency is considered by Delfs to be an important factor in about half the cases. She prefers to use intramuscular progesterone in these, since rather large amounts may be needed over long periods, and this preparation is practically free of risk of masculinization of the female fetus. Dosage is individualized to need as indicated by pregnandiol excretion or clinical symptoms of bleeding or uterine cramps. It may range from 25 to 200 mg. daily, the larger dosage being given in divided dosage, twice daily.

**Limitation of Activity.** Vigorous sports, strenuous activities and hard work are prohibited throughout pregnancy. Sedentary work and ordinary household duties are permitted without restriction, but avoidance of excessive fatigue is stressed. Bed rest is generally unnecessary for long periods but it should be advised for episodes of uterine irritability, cramping or bleeding. Coitus should be omitted for the first 4 months of pregnancy and should

be discontinued entirely if followed by discomfort or cramps.

### TREATMENT OF UNINFECTED, AFEBRILE ABORTIONS—INEVITABLE, COMPLETE AND INCOMPLETE

When, in the opinion of the physician, the abortion is inevitable, the ideal treatment is to complete it as soon as possible and in the most conservative manner. This should be done to prevent continued bleeding and to reduce the possibility of infection's ascending into the uterine cavity through the patulous cervix. There is often room for difference of opinion as to whether or not an abortion has passed from the threatened to the inevitable stage. There is no single criterion upon which the decision may be made, and often the greatest clinical judgment is required. Prolonged and profuse bleeding is the most significant sign that the pregnancy cannot be saved. However, it is difficult to state how profuse and how prolonged bleeding must be in order to indicate that the abortion is inevitable. Everyone with wide experience can recall cases in which, after great blood loss, a pregnancy has continued. However, when hemorrhage is alarming one is justified in assuming that the abortion is inevitable. As a general rule it may be stated that if treatment causes no cessation of the bleeding within a week, the abortion is certain. Again, there are many exceptions to this rule.

Cramplike pains, occurring at regular intervals and continuing after treatment, suggest that the time has come to help in the expulsion of the fetus. When the cervix has been dilated sufficiently to admit a finger, especially in the nulliparous woman, the chances of saving the fetus are poor. A slight dilatation of the parous cervix is less significant.

If hemorrhage does not necessitate immediate emptying of the uterus, often a pregnancy test may be of value. If negative, it is conclusive, but if positive one should bear in mind that sufficient chorion to give a positive test may remain alive for a week or more after fetal death.

The differentiation between an infected and an uninfected case is important but may

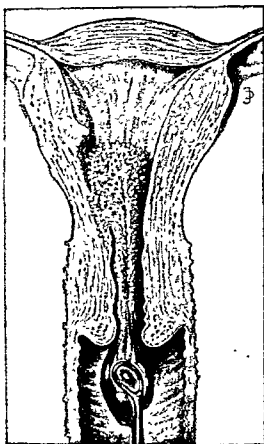


FIG. 315. Fetal membranes protruding from the cervix are removed with a sponge holder, which does not enter cervical canal.

be equally difficult. Any case in which there is an elevation of temperature to  $100^{\circ}$  F. for more than 24 hours must be considered infected. However, the absence of fever does not exclude infection, and an ovisac plugging the cervical canal and permitting absorption of intra-uterine blood may give rise to fever without bacterial infection. Nevertheless, an elevation of temperature is probably the most reliable single sign of infection. Leukocytosis is also significant. Most important is the history, and every effort must be made to learn the true facts. If there is a history or evidence of previous instrumentation, the chances for intra-uterine infection are so great that the case must be considered and treated as though there were intra-uterine infection.

When the physician has concluded that the abortion is inevitable and uninfected, the uterus should be emptied as rapidly as pos-

sible. It is our belief that evacuation of the products of conception by means of medical aid is, in general, preferable to instrumental aid. The patient is asked to help by bearing down, and she may be permitted to sit up in bed to aid in extruding the ovisac from the uterus and the vagina. One cc. of pituitary extract is given intramuscularly, repeated, if necessary, as often as every half hour up to 6 doses. Ergot is given at the same time as the pituitrin for the more prolonged action. Fluid extract in doses of 4 cc. every 4 hours up to 8 doses, or ergotrate at the same intervals in doses of 0.4 mg. is effective. An extension of ergot therapy for a longer time is unwise because of the possibility of poisoning. Penicillin therapy should be given prophylactically during this time.

If one adopts a policy of active medical treatment of abortions, a reasonable number will complete themselves spontaneously. However, there is much difference of opinion among obstetricians as to how long one should wait before resorting to operative interference. Taussig collected statistics from various European clinics and found that in Halban's Vienna Clinic only 5 per cent were completed spontaneously, whereas Fink, of Koenigsberg, was able to complete 35 per cent without instrumentation. It seems obvious, then, that by pursuing a conservative policy many unnecessary operations can be avoided. On the other hand, there will be a few cases in which retained placental tissue will require subsequent curettage. However, such a curettage is almost innocuous as compared with instrumentation done during the acute phase of the abortion.

Unless one has actually seen the intact ovisac, the question arises whether or not the abortion has been complete. When bleeding and cramps stop, one may assume that the abortion is complete, but in a certain percentage of cases one will guess incorrectly, as will become evident by a return of the bleeding. After bleeding has stopped, bed rest is desirable for about 5 days. If the abortion has been a late one, the rest may be extended to as long as 10 days. This may be an ultraconservative attitude, but we believe that it is justifiable. We recognize the fact that many women go through abortions with no rest and have no complications. However, this is not ideal from the stand-

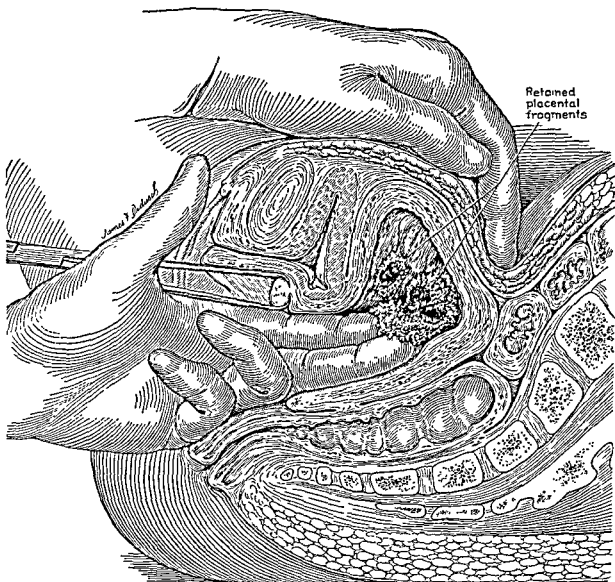


FIG. 316. Digital removal of retained placental fragments.

point of the patient's comfort or safety. At the end of the period of bed rest, the patient is kept in the hospital for 2 or 3 days. If bleeding is going to recur, it is apt to do so with her increased activity, and then she can be treated accordingly. In addition, the prolonged hospital stay keeps her from resuming her household duties, which she is apt to do if at home. Penicillin (300,000 units daily) during the hospital convalescence is of prophylactic value.

If a part or all of the products of conception are retained in the uninfected uterine cavity, it must be completely emptied with appropriate instruments. There is general agreement among gynecologists and obste-

tricians concerning this. However, there is considerable disagreement as to the method by which this is best accomplished. It appears that some of this disagreement is the result of prejudice rather than clear thinking. There is much prejudice, in general, against the use of the sharp curette. Some of this is justifiable, but the aversion which some obstetricians have to it is unfounded. For example, in very early pregnancy and when placental tissue of later pregnancy has been retained for weeks or even months, the uterus is often little, if any, larger or softer than the nonpregnant organ. The safe and most effective instrument for removing such products of conception is the ordinary serrated



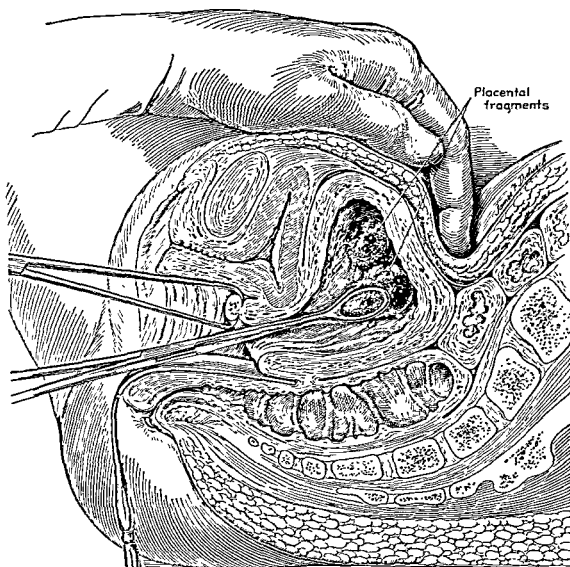


FIG. 317. Removal of placental fragments from uterus with sponge holder.

curette, such as is used for diagnostic curettage. On the other hand, many a soft pregnant uterus has been perforated with such a curette.

Sometimes, one need only place a speculum in the vagina and remove a large piece of placental tissue protruding from the cervix (Fig. 315). Generally speaking, in early pregnancy when the cervix is firm, much cervical dilatation is impossible. Evacuation by instruments is the method of choice in such cases. To attempt to dilate such a cervix to the point where a finger can be introduced might result in serious laceration.

Furthermore, the single finger introduced through a tight cervix is incapable of sufficient maneuvering to remove the ovisac or the placental remnants. In pregnancy advanced beyond 12 weeks, when sufficient cervical dilatation is attained, the placental tissue can often be loosened with the finger (Fig. 316) and removed with a sponge stick (Fig. 317). Also, the finger may be used as a guide to an instrument within the uterus. As a guiding rule one should remember that the larger and softer the uterus, the blunter should be the instrument selected, and the greater the care with which it should be used.

What has been said regarding the dangers of operative procedures in emptying the uterus per vaginam in therapeutic abortions is equally applicable in the treatment of incomplete abortion.

### TREATMENT OF INFECTED ABORTIONS

Prior to the antibiotic era there was unlimited literature advocating both the conservative and the radical treatment of infected abortion. For example, Brown and Hunt in 1936 urged the emptying of the uterus regardless of the severity of the infection, and giving an intra-uterine douche of potassium permanganate solution (1:1,000). Such active treatment was heresy to the majority of gynecologists of that day, most of whom were more conservatively minded. However, their mortality in a city hospital with the usual run of sick patients from the lower strata of society was only 1.4 per cent, and the average hospital stay was 6.3 days. The patients who died were said to have been moribund on admission.

On the other hand, Witherspoon reported on 200 cases of septic abortion at the Charity Hospital in New Orleans and concluded that the conservative treatment was superior. In 100 cases that were treated by some operative procedure, the minimum of which was dilatation and curettage, the mortality was 9 per cent. In the second 100 cases treated conservatively, without any instrumentation, there were no deaths. Sixty-four of the patients who were curetted were made more septic as judged by increased febrile reaction. From this experience, Witherspoon strongly urged that every effort be made to avoid operative intervention. Reports in the literature to support these divergent views could be quoted indefinitely, but the problem cannot be settled in this manner.

Antibiotic therapy has been a tremendous factor in lessening the mortality from septic abortion. However, bacterial infection has not been forever eradicated from the obstetric wards by modern aseptic technic and certainly not from the abortionist. Strains of bacteria resistant to the commonly employed antibiotics have emerged, and the patterns of infection have changed. In the light of these facts the management and the treat-

ment of infected abortions must be re-evaluated. The mildly infected abortion usually responds promptly to several injections of 300,000 units of penicillin. After a few such injections the residual products of conception may be removed promptly, if necessary, as judged by bleeding or persistent temperature elevation.

There is a small percentage of the patients who are destined to be seriously ill, and while there are suggestive signs of serious infection which may appear early, there is none which can be considered as being pathognomonic. Therefore, all the patients must be considered as potentially serious and treated accordingly. We refer to the cases of enterobacillary septicemia who suffer from hypotension from bacterial shock described by Studdiford and Douglas. The signs of septic abortion (fever, cramps, vaginal bleeding, chills and sweats) when coupled with a history of criminal interference, hypoactive bowel sounds, vomiting and a closed cervical os should make one suspicious that bacterial shock may be pending. Blood cultures and cervical cultures should be taken immediately, and a smear taken from the cervix and stained by Gram's method. This may disclose gram-negative bacilli which should make one suspect the serious nature of the infection. The organisms commonly responsible for bacterial shock are, in order of frequency, *Escherichia coli*, *Pseudomonas aeruginosa* and *Proteus vulgaris*. These organisms are all sensitive to streptomycin, which should be given intramuscularly in dosage of 2 to 4 Gm. daily. However, if the patient is already in shock, the absorption of the drug is questionable. Therefore, chloramphenicol, to which these organisms are also sensitive, should be given by intravenous infusion in 0.5 to 2.0 Gm. per liter. Hematocrit determinations should be made frequently to watch for hemoconcentration, and intravenous fluids should be regulated accordingly. Norepinephrine may be given as indicated to raise the blood pressure. Oxygen administration is often helpful. Hydrocortisone given in the intravenous fluids is thought by some to be of value. A retention catheter should be placed in the bladder, and urinary output should be measured. It should be above 40 cc. per hour, and the specific gravity should be determined

on the hourly specimens. Early renal failure may be first suspected by a fixation of specific gravity.

Most of those who are experienced in this disease now are of the opinion that the uterus should be emptied promptly, probably within 12 hours after the beginning of the above-mentioned therapy. They are of the opinion that this should be done even though the patient has responded well, for some patients have been known to respond and then return to shock, presumably from a new shower of bacteria from the infected uterus or the absorption of products of decomposed tissue from the uterine cavity.

### EXTRA-UTERINE SEPTIC INFECTION

Septic abortion, in which the infection has passed beyond the confines of the uterus, presents a problem in therapy quite different

from that of infected abortion in which the infection is limited to the uterus. Whereas there is considerable justifiable difference of opinion as to the advisability of intra-uterine manipulation in the latter type of case, almost everyone is in agreement that intra-uterine instrumentation is contraindicated when there is extension beyond the uterus. In order to consider treatment intelligently, a short review of the pathology is desirable.

### PATHOLOGY

The organisms that penetrate beyond the uterine wall are in the vast majority of cases streptococci, but staphylococci and the Welsh bacilli may also be the primary invading agents. Most of the streptococci are anaerobic; the incidence of hemolytic streptococci was found by Brown and Hunt to be only 1.8 per cent. However, the importance of hemolytic streptococci as a factor

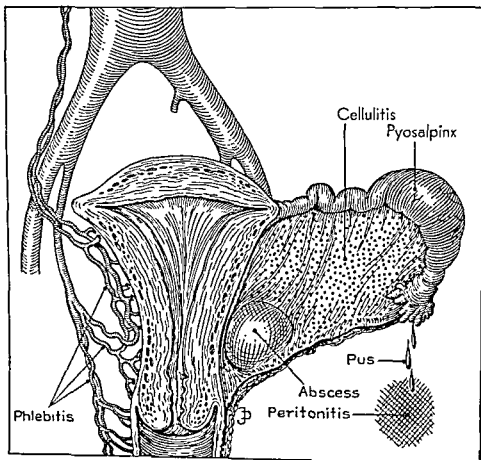


FIG. 318. Diagram illustrating methods of extension of abortive infection.

in mortality must be stressed, since in 57.1 per cent of their fatal cases the hemolytic streptococcus was isolated. All of the above-mentioned organisms have the ability to invade tissues and have been labeled by Curtis as the "cellulitis" group. As a result of invasion by these organisms cellulitis, salpingitis, peritonitis, thrombophlebitis, septicemia and distant embolic abscesses may form (Fig. 318).

At the beginning of the inflammatory process within the uterine cavity, an attempt is made to limit its extension by the outpouring of leukocytes which, with the aid of fibrin, form a wall in the endometrium and the myometrium. In the majority of cases, this barrier and the antibodies in the blood are successful in preventing the spread of the infection, but in certain cases the organisms penetrate the leukocytic wall and enter the myometrium. In addition to intra-uterine infection, organisms enter the cervical tissues through fresh lacerations. If the penetration is not halted, the organisms pass through the musculofibrous wall of the corpus and the cervix, and the parametrial and the paracervical tissues are invaded. Exudate pours into these tissues, and they become greatly thickened. This process is subperitoneal and may be unilateral or bilateral. As it advances, all the connective tissue surrounding the uterus, the rectum, the bladder and the ureters thickens, and these organs become solidly fixed. The infection may advance upward along the course of the ureter to the perinephric region or downward into the paravaginal tissues. The cellulitis, which is thus formed, may persist as such or break down into abscesses. The cellulitis is of ligneous consistency and even when abscesses do result, the walls may be formed by thick "cellulitis" tissue that gives no clue as to the liquefied interior. Abscess may form low in the broad ligament and be palpable per vaginam, or it may form in the upper part of the ligament and be present above Poupart's ligament.

In addition to the ability of these organisms to penetrate tissue, they also may travel along the surface of the endometrium and out through the tubal lumina. Pyosalpinges form from streptococcal and staphylococcal infections, which may be indistinguishable grossly from neisserian pus tubes. The state-

ment is frequently made in the literature that tubal infections resulting from abortions are of the peritubal type. This is frequently true as the result of the tube's becoming involved from broad ligament cellulitis or from peritonitis. However, a true endosalpingitis from extension of infection from the uterine cavity has often been demonstrated.

Organisms passing through the tubes enter the peritoneal cavity, and peritonitis results. Such peritonitis may be limited by adhesions to the pelvis where localized abscesses can form in the cul-de-sac or elsewhere. More often, however, the peritonitis becomes generalized. The tendency to general peritonitis is much greater than with neisserian infection. The peritoneum may also become infected with lightning speed as a result of perforation of the infected uterus by a surgical instrument. In addition, the peritoneum may be infected via the lymphatics from infection in the subperitoneal spaces. In a similar manner, the ovary may become abscessed through the lymphatics.

Extension of the infection by the venous route is one of the most serious complications. Fortunately, this occurs in a relatively small percentage of the cases. Brown and Hunt, for example, obtained positive blood cultures in only 8 of 500 cases of abortion. However, it is noteworthy that of the 7 women who died in their series, 5 had positive blood cultures. It should be considered, however, that showers of cocci may enter the blood stream from time to time and be missed on culture. In some of the cases a septic thrombophlebitis occurs in the pelvic veins, which may be considered as a defense mechanism against the invading organisms. When the thrombosis extends to the femoral veins, the typical picture of phlegmasia alba dolens results. In other cases there are no thromboses, and the organisms enter the blood freely from the infected uterus and extra-uterine tissues. Abscesses may occur in almost any distant part of the body as a result of hematogenous dissemination of the infection.

#### TREATMENT

When dealing with septic abortion, one of the first things to ascertain is whether or not the infection has extended beyond the con-

lines of the uterus. The signs of peritonitis should be looked for. Palpation of the lower abdomen for adnexal enlargement or for broad ligament abscess, presenting above Poupart's ligament, should be done. However, the most revealing procedure is the pelvic examination, made with a sterile glove. First, a 2-finger examination is made; then the index finger is left in the vagina, and the middle finger is inserted into the rectum. Broad ligament induration can best be palpated by the combined vaginal and rectal examination. Broad ligament and adnexal thickening and tenderness are definite indications of extension of the infection beyond the uterus. These examinations should be gentle and not repeated oftener than is necessary to keep one informed regarding the progress of the disease.

The patient is put at rest in semi-Fowler's position, and an ice cap is placed on the lower abdomen. Nourishment and fluids are maintained by intravenous administration of glucose solution. If there is abdominal distention from peritonitis, frequent enemas are given, and a duodenal or Wangenstein suction system is instituted. Penicillin is given in doses of 300,000 units as often as every 4 hours in the more severe cases. If the patient fails to respond promptly, streptomycin is given in addition. Antibiotics are continued as long as the temperature remains elevated. The patient is often anemic in the early stage of the disease, due to recent hemorrhage. Later, progressive anemia develops as a result of blood destruction by the infection. Repeated transfusions help the patient to combat the infection; often they are lifesaving.

If the patient shows steady improvement, she should not be disturbed by frequent pelvic examinations. If she does not improve, gentle abdomino-vagino-rectal examinations should be made as often as the physician thinks necessary to keep informed of the course of the disease. Dissemination of the pelvic infection can result from rough examinations, which should be scrupulously avoided. Evidence of localization of the infection as abscesses in the peritoneal cavity, the cul-de-sac, or the broad ligament should be carefully noted, and the abscesses should be drained without delay.

Fortunate is the patient with peritonitis in whom there is localization of an abscess in the cul-de-sac, where drainage by colpotomy is easy and effective. When there is evidence of localization of an abscess higher in the abdomen, it should be drained through a small incision directly over it. The question arises as to the advisability of drainage in septic postabortive peritonitis when there is no clinical evidence of localization of an abscess. Certainly laparotomy should not be done as soon as the diagnosis of peritonitis is made. Many cases respond promptly to antibiotics and simple nursing measures. However, if after 48, or perhaps 72, hours it becomes apparent that the patient is not improving, drainage of the peritoneal cavity is advisable. This statement is made with the realization that opinion may differ on this point. There is always the possibility of a localized abscess, the presence of which cannot be proved preoperatively. The drainage of such an abscess may cure the patient. If no indication exists that there is localization of the infection in the abdomen, a short mid-line incision should be made in the suprapubic region. If there is a quantity of free pus in the peritoneal cavity, bilateral stab wounds are made in both lower quadrants, under the guidance of the fingers inserted in the abdomen through the mid-line incision. Taussig reports that Sigwart was able to save 7 of 12 patients in this way, making a mortality of 41 per cent, in contrast with the usual reported mortality for abortive peritonitis of 65 to 78 per cent in the days before chemotherapy or antibiotics.

When the infection is limited to the subperitoneal spaces and the cellulitis breaks down to form an abscess, recovery is hastened by drainage. Figure 318 illustrates the usual sites of abscess formation. If the abscess points in the base of the broad ligament, it can be drained ideally by posterior colpotomy (Fig. 300). An incision is made through the vaginal mucosa in the mid-line, just behind the cervix. After passing a long Kelly clamp through this incision, it is directed laterally into the abscess. The jaws of the clamp are spread, and then often the tract can be enlarged with the finger. Cigarette drains are placed in the cavity. If the broad ligament abscess is present above one

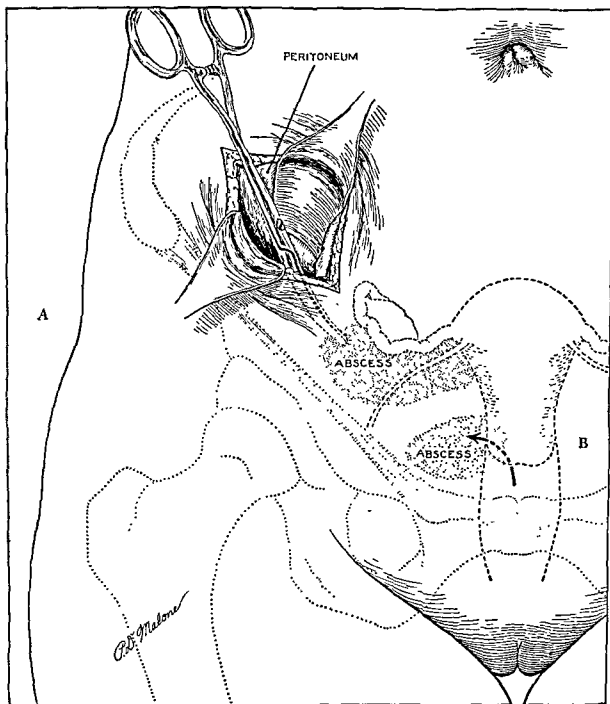


FIG. 319. Illustrating two possible methods of drainage of broad ligament abscesses. (A) Extraperitoneal abdominal route. (B) Vaginal route.

of the inguinal ligaments, it can be felt by abdominal palpation. A small muscle-splitting incision is made over it, down to the preperitoneal space. Then a long Kelly clamp is inserted downward and inward toward the abscess cavity (Fig. 319). The drainage tract is enlarged with the finger, and cigarette

drains are inserted into the abscess cavity.

When acute cellulitis persists and the temperature remains septic, diathermy treatments are instituted, which may hasten the breaking down of the inflamed tissue into an abscess. The question as to whether or not an abscess has actually formed is, at

times, difficult to solve. Even a fairly large abscess may be encased in a thick rigid capsule of cellulitis tissue, and no fluctuation will be palpable. If spiking fever persists, we believe that it is justifiable to penetrate into such indurated tissue either via the cul-de-sac or the abdominal route. Not infrequently one will be rewarded by finding pus, but if unsuccessful the breaking into the cellulitis tissue, well walled off between the leaves of the broad ligament, will do no harm. Even if no pus is found, drains are inserted, and eventually the tissues may break down along the drainage tract. Drainage from such cellulitis tissue is often of long duration, but ultimate resolution probably is hastened.

The treatment of thrombophlebitis is discussed in Chapter 5, "Postoperative Care and Complications," and the same principles of treatment apply to postabortive phlebitis.

Chronic postabortive infection in the adnexa and the broad ligaments presents a special therapeutic problem. It has been shown by Curtis that streptococci often persist in the pelvic tissues for months and even years. If the organisms persist in such virulence as to be responsible for daily temperature elevations, a course of antibiotics should be instituted, or small doses of sulfonamides may be given over a prolonged period. Even when there is no temperature elevation, the aim of therapy should be to restore the pelvic organs to as near normalcy as possible. Often persistently thickened adnexa and broad ligaments may be restored almost to their previous condition by regular diathermy treatments, provided that they are carried out religiously for weeks or even months. Surgical measures should be deferred much longer than in neisserian disease. Streptococci live much longer in the tissues than gonococci, and there is greater danger of dissemination of virulent organisms by surgical trauma. Since the tubal inflammation often takes the form of perisalpingitis, the tubes have a much greater chance of remaining patent. If future pregnancies are desired, one should be ultraconservative with regard to surgery, in the hope that the lumina of the tubes will be preserved. It is truly remarkable what may be accomplished if diathermy and douching are persisted in. Pelves which are almost solid with cellulitis may,

with great patience, often be restored ultimately to an almost normal condition.

However, in spite of prolonged conservative treatment, surgery is required in a small percentage of these women to restore health. Chronic infection of the cervix frequently follows abortions and requires surgical attention. The resulting adherent uterus, adnexal and intestinal adhesions may be responsible for persistent pain. Chronic abscess in the ovary or the tube and the ovary may interfere with normal health. Functional bleeding, due to disturbed ovarian function, may be sufficiently troublesome to require surgery. Rarely, the freeing of adhesions about the tubes may be justified because of sterility. The best surgical procedure must be decided upon at the operation. Hysterectomy, salpingectomy, uterine suspension, cervical cauterization are all procedures that may be required to restore the patient to health.

#### PERFORATION OF THE PREGNANT UTERUS

Perforation of the uterus is one of the more frequent complications of emptying the pregnant womb. The real incidence is, of course, difficult to learn. Since the fault is usually the operator's, most cases fail to find their way into the literature. However, most well-trained gynecologists will admit that they have punctured one or more pregnant uteri in the course of their careers. Among the less experienced the incidence must be much greater.

Prevention requires careful consideration, for the condition has a high mortality. First, an exact preoperative knowledge of the size, the consistency and the position of the uterus will reduce the chances of perforation. Also, one should make certain that the bladder is completely emptied by catheter so that the uterus is not displaced by a full bladder. Sufficient dilatation of the cervix to permit the easy handling of instruments or to permit the use of the finger in loosening the membranes is an important factor in lessening the possibility of perforation. One should measure carefully the depth of the uterus with a uterine sound at the beginning of the operation and avoid passing dilators or other instruments beyond that depth. The use of the ovum forceps only for removal of loosened pieces of tissue, rather than forcibly

tearing the sac from the wall, is wise because a piece of myometrium can easily be torn away (Fig. 311) and an instrument passed through the weakened spot.

The prompt recognition of the perforation is of the utmost importance. The passage of an instrument beyond the depth of the uterine cavity is diagnostic. When the operator suspects that he has perforated the uterus, he is justified in carefully and slowly passing a blunt uterine sound through the suspected perforation to determine with certainty whether or not the wall has been perforated. The appearance of intestines within the grasp of the ovum forceps is sad but certain evidence that the uterus has been perforated and the intestines brought through the opening, with probable injury to the intestinal wall. Evidence of internal hemorrhage following the instrumentation is also diagnostic. This does not usually become evident until after the patient has left the operating room.

From the standpoint of treatment, accidental perforation of the uterus can be grouped into three categories:

1. Perforation while doing a clean therapeutic abortion.

2. Perforation while completing an incomplete abortion.

3. Perforations previously done, often by an abortionist or the patient, whose sterile technic is open to question.

The treatment of perforation of a clean pregnant uterus during a therapeutic abortion differs with the instrument with which it is done, the site of perforation and other circumstances. When the cervix is perforated with a dilator, the opening should be closed at once. Anteriorly, the bladder can be dissected up from its cervical attachment, and the rent in the uterus can be exposed and sutured. If the bladder has been entered, it should be closed with 2 layers of fine chromic catgut. If the perforation is in the posterior wall of the cervix, the cul-de-sac should be opened through the posterior fornix. By means of retractors the wound can be exposed and sutured.

When the perforation is through the corpus uteri, a decision must be made whether to open the abdomen immediately or treat the patient expectantly. Opinion is divided. Our own view is that if the perforation is done with a curette or a uterine sound and

if it is a reasonable supposition that the intestines have not been injured, the patient may be treated expectantly. By a "reasonable supposition that the intestines have not been injured" we mean that if there is simply the passage of a sound or a curette further than the limits of the uterus and the instrument is withdrawn promptly, it is unlikely that there is any injury to the bowel wall. If, on the other hand, the operator has reason to believe that he has curetted the contents of the abdominal cavity, he must recognize the possibility of intestinal injury and perform an immediate laparotomy. If the perforation is done with a sponge holder or ovum forceps, there is less likelihood of intestinal injury, and the treatment may be expectant. If bowel is brought out of the cervix with an instrument, it should be pushed back into the uterine cavity, and the abdomen should be opened immediately.

Expectant treatment is begun in the operating room. The pulse and the blood pressure should be taken repeatedly. While the patient is thus observed, preparation for laparotomy is begun so that, if it becomes necessary, there will be no delay. If the pulse and the blood pressure remain unaltered, and if the operator feels that it is unlikely that he has injured the bowel, the patient is sent to the recovery room. An ampule of pituitrin is given, and a course of ergot is started. An ice cap is put on the lower abdomen, and the patient is placed in Fowler's position. Penicillin is given immediately and 300,000 units given every 4 hours. Streptomycin also is given intramuscularly in a dosage of 1 Gm. every 4 hours. If the patient develops signs of internal hemorrhage or peritonitis, a laparotomy is done without delay.

On opening the abdomen the question of closing the opening in the uterus versus hysterectomy must be considered. The age of the patient and the desirability of more children are important factors in making the decision. Often sterilization is desirable for the very reason that the abortion was done. Because of the condition of the patient a rapid hysterectomy is advisable, and the surgeon must decide whether or not to do a total or subtotal operation. He must take into consideration his own operating ability as well as the patient's condition in making



the decision. When local infection has developed as a result of the perforation, hysterectomy is usually preferable, but when there is general peritonitis and the patient's condition is poor, simple suturing of the perforation is wiser. If there has been injury to the bowel it, of course, should be repaired. Drainage down to the perforated area is advisable, and although sulfanilamide powder may be introduced into the peritoneal cavity, we now depend chiefly on antibiotics to overcome the infection.

When there is no infection, and preservation of the childbearing function is desirable, suturing the uterine rent and thus controlling hemorrhage is permissible.

When perforation is done in completing an incomplete abortion, one should proceed on the assumption that an infected uterus has been punctured, because an incomplete abortion is usually infected even though there are no clinical signs to indicate it. Whereas formerly we advocated immediate laparotomy in such cases, we feel justified today in watchful waiting while treating the patient intensively with antibiotics. If observation indicates that there is either continuing hemorrhage or spreading infection, laparotomy should be done. If perforation was done sometime previously and infection has extended beyond the uterus, hysterectomy would open up lymphatics and blood vessels in the presence of gross infection and might be fatal. Under such conditions closure of the perforation, the introduction of sulfanilamide powder, drainage and antibiotic therapy are all that should be attempted.

The youth of the patient and the desire for future children may tempt one to close the perforation rather than perform hysterectomy. It should be recalled that when dealing

with incomplete abortions the situation with regard to future pregnancies is generally quite different than when concerned with therapeutic abortions.

When one sees, in consultation, a case of suspected perforation that has been previously instrumented by a colleague, an abortionist or the patient herself, the question that first arises is whether one is dealing with a uterus that actually has been perforated or with a simple infected abortion. If possible, the previous operator should be questioned for evidence, but often he is not accessible. The history of sudden collapse during the instrumentation, or the sudden development of signs of severe infection or hemorrhage after the instrumentation is suggestive of perforation. Intensive antibiotic therapy should be started at once. Laparotomy is indicated if the symptoms and the findings on examination of the abdomen and the pelvis suggest peritoneal infection or irritation by intra-abdominal hemorrhage. Even when one cannot be certain from abdominal or pelvic findings, there is always the possibility of a localized abscess or an infected hematoma. One should not defer surgery until one is certain of a localized collection of blood or pus, because the differentiation between such a condition and generalized peritonitis may be extremely difficult. Indeed, in some instances there is a generalized peritonitis associated with a more or less localized abscess in the pelvis. In most of the cases of this type the inflammatory process has progressed so far that drainage and antibiotic therapy are all that should be attempted, further surgery in the presence of advanced extra-uterine infection being contraindicated.

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# Tuberculosis of the Female Generative Organs

The first recorded case of tuberculosis of the female genital organs was described by Morgagni in 1761. It was found in the course of an autopsy on a young woman whose tubes and uterus were filled with caseous material. Since then there has been an enormous amount of literature on the subject. In the United States there has been a decline in the incidence of tuberculosis, and with this decline in the disease generally there has been a lessening of the incidence of genital tuberculosis. The reduced incidence noted in the United States has not been the case throughout many parts of the world. Segovia, Bunster and Parrochia state that "In the last few years careful statistical and epidemiological studies have shown that tuberculosis in all its manifestations represents one of the major problems we have to deal with in Chile. Tuberculosis is beyond a doubt Chile's most important infectious disease." Professor Wood of the University of Chile confirms this impression when he states that "over the last ten years, of all hospitalized patients, 3 per cent were affected with genital tuberculosis; in patients hospitalized for adnexal inflammatory processes, 11.5 per cent had this gynecopathy." This incidence of genital tuberculosis is approximately 3 times the incidence on our service where the incidence was 3.9 per cent from 1920 to 1950. Nelson *et al.* from Toronto report an increased incidence in Canada in recent years due to an influx of European immigrants. Involvement of the female generative organs is practically always secondary to a tuberculous focus elsewhere in the body, and one always should bear in mind this fact when considering treatment. The

site of that focus, its extent and activity, as well as the local lesion, should be weighed carefully before a decision is made as to the best therapy for the pelvic lesion. In order to consider intelligently the treatment of genital tuberculosis, a review of some of the salient points concerning its pathology and diagnosis should be made.

## PATHOLOGY

In an exhaustive clinical and pathologic study made by Greenberg in our laboratory, he found tubal involvement in 100 per cent, vaginal involvement in 0.5 per cent and corpus uteri involvement in 45 per cent. If the involvement of the corpus uteri is figured on the basis of only those cases in which the uterus was removed and made available for microscopic study, the percentage becomes 72.6. The endometrium is the portion of the uterus most frequently affected. Greenberg found it to be the site of infection in 95 per cent of the affected uteri. In only 5 per cent was the myometrium tuberculous and the endometrium free from infection. Since Greenberg's study was based on tuberculous tubes found in the laboratory, it is apparent that in his series tubal involvement should be 100 per cent. That the tubes are not always the primary site of secondary pelvic tuberculosis is indicated by the fact that during the period covered by Greenberg's study of the 200 cases of tuberculous salpingitis he found in the laboratory 2 cases of tuberculosis of the cervix without salpingitis. Reuben Peterson, reporting on a pathologic study of tuberculosis of the female genitalia, found tubal involvement in 86.3 per cent, uterine in 50 per cent and ovarian in 43 per

cent. More recently, Lackner, Schiller and Tulskey made a study of endometrial biopsies taken from 125 women with tuberculosis of the lungs. They found endometrial infection, without clinical evidence of involvement, in 2 women. In the Cook County Hospital autopsy material there were 2 instances of endometrial infection without tubal involvement in 113 cases of tuberculosis of the lungs. It is our belief that these cases of endometrial tuberculosis are of hematogenous origin from distant foci. There are series of genital tuberculosis recorded in the literature in which the incidence of endometrial tuberculosis exceeds that of tubal involvement, as, for example, Sutherland and Garrey, who report endometrial involvement in 48 per cent and tubal involvement in 37 per cent. They admit that the tubes were not examined histologically in the majority of the cases. This completely nullified the value of their statistics, which can only mislead the uncritical reader. For example,

Jameson states that the pathologist at Saranac Lake was of the opinion that pelvic tuberculosis was rarely seen at autopsy in women dying of tuberculosis, and yet when the pelvic organs of 17 consecutive women coming to autopsy were examined painstakingly, 6 were found to have microscopic lesions.

It is desirable to distinguish tuberculous from nontuberculous tubes at the operating table, but it is remarkable how often they are not recognized by gynecologists of good pathologic training. Like gonococcal tubes, those of a tuberculous nature are almost always bilateral. Greenberg found them to be so in 99 per cent of his cases. Tuberculous infection of the tubes may be of an endotubal or peritubal nature. In many instances both the endosalpinx and the serosa are involved. Endosalpingitis is the more common form, and it represents a hematogenous infection from a distant focus. These tubes may appear very much like subacutely or chroni-

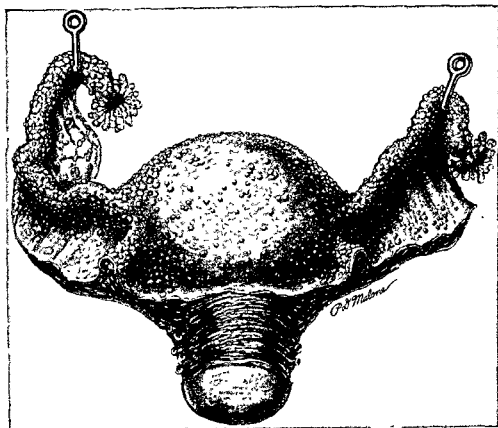


FIG. 320. Typical specimen of tuberculosis of generative organs as part of generalized tuberculous peritonitis.



FIG. 321. Tuberculosis of the fallopian tube. Note the multinucleated giant cells.

cally infected tubes of neisserian origin, or they may take the form of sausage-shaped pus tubes. In the less acute form, they may be nodular with areas of caseation and constriction. The fimbriated ends are less apt to be inverted with club-shaped ends than in gonococcal tubes. A constriction near the fimbriated end sometimes causes the ends to evert like the end of a sac tied with a string. But these same characteristics are often reproduced by gonococcal or streptococcal tubes, and unless the serosal surface and the adjacent peritoneum show tubercles, the tuberculous nature cannot always be recognized (Fig. 320).

Perisalpingitis is usually only a small part of serosal tuberculosis which involves the parietal and the visceral peritoneum. The many small widespread opalescent tubercles make the diagnosis evident. The fact that these tubes *appear* to be involved *only* on the serous surface does not prove that the endosalpinx is not involved in the infection. In fact, Faulkner and Everett found that *all* tubes removed from patients with tuberculous peritonitis showed endosalpingitis mi-

croscopically. This point has an important bearing on therapy. In some instances the tuberculous peritonitis is quite localized in the pelvis and seems to be the direct result of dissemination of the infection from the tubes. Tuberculous material escapes from the interior of the infected tubes and infects the serosa of the tubes, the surface of the ovaries and the adjacent peritoneum. Often these tubercles are few, but a sufficient number can be recognized to identify the tuberculous nature of the tubal disease (Fig. 321).

The ovarian lesion is usually a perioophoritis. The thick tunica albuginea serves as a good mechanism of defense, but breaks in the ovarian surface, due to ovulation, may permit the entrance of tubercle bacilli and invasion of the parenchyma. At times, even large tubo-ovarian abscesses, simulating clinically gonococcal abscesses, form.

The mode of infection of the uterus is usually via the tubes. The tuberculous material from the tubes works into the uterine cavity and gives origin to tuberculous endometritis. The disease is most advanced in the fundus, but in some instances the entire endometrial cavity eventually becomes involved. The myometrium usually becomes infected by direct extension from within, but it may also be infected from without, due to tuberculous tubes lying adherent to the uterus. In advanced cases, all the pelvic organs, together with bowel, may be matted together to form a mass, riddled with caseation and abscesses. Such tuberculous masses are among the most formidable lesions that the surgeon must face in the female pelvis.

Some degree of peritonitis commonly accompanies tuberculous salpingitis. Greenberg found peritonitis associated in 63 per cent of his cases. From a pathologic standpoint, and also clinically, tuberculous peritonitis can be divided into three groups. From a therapeutic viewpoint it is essential to recognize these forms of the disease. First, in the "wet" type of peritonitis there is an outpouring of straw-colored fluid into the peritoneal cavity. The peritoneum of the parietal wall and the viscera is covered with innumerable small tubercles. The serosal surface of the pelvic viscera is involved with the serosa which covers the intestines. The tubes, usually slightly enlarged, are edematous, due to

perisalpingitis; it is apparent that this form of peritonitis, associated with tubes of this nature, is *hematogenous in origin* and that the serosa of the pelvic viscera receives its shower of tubercle bacilli along with the rest of the peritoneum through the blood stream. However, in some cases of the wet tuberculous peritonitis the tubes are more markedly enlarged, and the endosalpinx is obviously grossly infected, as well as the serosa.

Another type of peritonitis encountered in the female is the dry or adhesive type. Bowel adheres to bowel by innumerable dense adhesions that blend with the musculature. Indeed, the muscle of the bowel is often invaded to some degree by the tuberculous process. Separation of these adhesions is extremely difficult surgically, and accidental injury to the bowel is common. Associated with this type of tuberculous peritonitis there is always a serosal involvement of the pelvic viscera, but in many instances there is also gross enlargement of the tubes and the pyosalpinges, and even tubo-ovarian abscesses may form.

The third type of tuberculous peritonitis is of particular interest to the gynecologist. It represents an obvious direct extension of the tuberculous process from within the tubes to the surrounding peritoneum. On the serosa of the tubes and the uterus, on the sigmoid, perhaps on the cecum, the appendix or the lower ileum, there are scattered tubercles. It is possible that this *localized peritoneal infection* is, in some instances, the forerunner of the more extensive types of peritonitis discussed above. From a therapeutic viewpoint this form responds very satisfactorily to pelvic surgery.

### DIAGNOSIS

The diagnosis of tuberculosis of the tubes is usually made clinically with difficulty unless there is definite evidence of tuberculous peritonitis. Greenberg found that only 13 per cent of his cases of tuberculous salpingitis had been diagnosed correctly, and over half of these were associated with ascites.

Since tuberculosis of the the genitalia is rarely primary, there is often in the history some evidence of a tuberculous infection elsewhere in the body. In approximately half of the cases there is active or inactive

pulmonary disease. As a result of this there is frequently a history of impairment of general health, either at the time the patient seeks help for the pelvic symptoms or at an earlier date. A history of physical evidence of bone tuberculosis may, likewise, be a valuable clue.

The condition most commonly confused with tuberculous salpingitis is gonococcal tubal disease. In our own Negro wards the mistake is commonly made of considering the tuberculous adnexal disease to be of gonococcal origin. Failure of response to the usually conservative treatment causes us to suspect the tuberculous nature of the disease, and upon this we diagnose tuberculosis more often than any single sign or symptoms, except ascites. Puerperal and postabortal pelvic infections may also be confused with tuberculosis, because not infrequently the symptoms of the tuberculous salpingitis become manifest after delivery or abortion. Adnexal thickening, due to endometriosis, can be confused with pelvic tuberculosis, especially in *virginal women*. When there is ascites, a differential diagnosis must be made from papillary ovarian cancer.

The age of the patient may be helpful in arriving at the correct diagnosis. The greatest incidence of all types of tubal disease is between 20 and 40, so that, as a rule, age gives no special clue as to etiology. However, tuberculosis is the most common cause of *pelvic inflammatory disease in the early teens*. The occurrence of salpingitis in a very young girl always should make one suspicious of tuberculosis, and the suspicion can be converted into a strong probability when an intact hymen is present. When ascites is present and the differential diagnosis lies between genital tuberculosis with peritonitis and papillary ovarian cancer with peritoneal implants, the age of the patient may be of considerable weight; the younger the individual, the greater the chances are of tuberculosis; and the older the patient, the greater the chances of ovarian neoplasm; this is a general rule, but there are exceptions.

Abdominal pain is usually the presenting symptom, and in most instances it is bilateral. In our recent study it was complained of in 69 per cent. An insidious onset of the pain is suggestive of tuberculosis, but we

have seen many cases of tuberculosis of the tubes in which the onset was as acute as in a neisserian or streptococcal infection. In general, however, it can be said that with a given amount of adnexal disease there is usually less spontaneous pain with the tuberculous than with the nontuberculous lesion.

The relation of the pelvic symptoms to menstrual disturbances may aid in making an accurate diagnosis. With both gonococcal and streptococcal pelvic infection, menstrual changes—if any—follow the onset of the infection. In pelvic tuberculosis, it is common to obtain a history of decreased flow prior to the onset of the pelvic pain, since a decrease of the menstrual flow depends more upon the generalized or pulmonary infection than upon the genital lesion. In a recent study in our clinic by Brown, Gilbert and the author the following menstrual disturbances were noted:

	PER CENT
Menorrhagia . . . . .	20.2
Amenorrhœa . . . . .	15.8
Oligomenorrhœa . . . . .	11.3
Dysmenorrhœa . . . . .	8.8
Polymenorrhœa . . . . .	6.3
Intermenstrual bleeding . . . . .	10.1

It is obvious from these figures that the menstrual changes associated with tuberculous salpingitis are, in many instances, similar to those with gonococcal and streptococcal tubal disease. Dysmenorrhœa and menorrhagia are common in all types of pelvic inflammatory disease. Nevertheless, diminution of menstrual flow is much more common in tuberculosis. Amenorrhœa is extremely rare, and oligomenorrhœa is uncommon in nontuberculous pelvic inflammatory disease, whereas in tuberculous salpingitis amenorrhœa or oligomenorrhœa occurred in 27 per cent of the cases. From these facts, we are able to conclude that when salpingitis is accompanied by a decrease in menstrual flow tuberculosis should be considered.

Fever of more than 99.2° was present in 62.5 per cent of Greenberg's cases. In those with peritoneal involvement it was present in 65.8 per cent; in those cases in which the infection was limited to the pelvic organs it was present in only 34.2 per cent. Thus it is apparent that a third of the pa-

tients with peritonitis and two thirds of those without peritoneal involvement were afebrile. The afebrile state of patients, with residues of neisserian and streptococcal infections, is generally recognized, but it is doubtful whether or not there is general understanding of the fairly large incidence of the absence of fever with pelvic tuberculosis.

Since the acute and the subacute stages of gonococcal infection are usually shortlived, and since streptococcal infections either kill or run a fever of not more than several weeks, a history of continued temperature elevation of 102° or more over many weeks is very suggestive of pelvic tuberculosis. In fact, when a patient with obvious pelvic infection and a high fever fails to respond to bed rest, the usual antibiotic therapy and/or diathermy within 2 or 3 weeks, we suspect tuberculosis.

A moderate degree of leukocytosis is the rule during the acute attack of gonococcal tubal disease. With an inactive neisserian residue the white blood count is usually normal. With acute streptococcal pelvic infection the leukocytosis is usually higher than in gonococcal infection, but leukocytosis subsides with the fever. With tuberculous infections it is not the rule for the white blood count to be elevated in proportion to the temperature. In 70.5 per cent of our patients the leukocyte count was between 5,000 and 10,000, below 5,000 in 7.5 per cent and above 10,000 in 21.8 per cent. When there is an appreciable leukocytosis there is commonly a large collection of pus in a tubo-ovarian abscess or the cul-de-sac, and in some instances secondary infection is also present.

An appreciable anemia is present in the majority of cases of tuberculous salpingitis; it is especially apt to be present when an active pulmonary lesion is present. The average hemoglobin in our cases was 75.3 per cent. With streptococcal infections anemia often develops rapidly. Gonorrheal tubal infection is not usually causative of much anemia, but in our experience in the colored wards, anemia is extremely common in patients with all types of gynecologic disease, a fact that is undoubtedly due, in many instances, to dietary deficiencies. Hence, in patients of that class one must be extremely cautious in interpreting the anemia as evi-

dence for either tuberculosis or streptococcal disease.

On physical examination and/or x-ray examination evidence of pulmonary tuberculosis, active or inactive, is found in over half of the patients with pelvic tuberculosis. For this reason its presence is strong evidence for the tuberculous nature of the tubes. Signs of tuberculosis of the bones, the larynx and the lymph glands should also cause one to consider a tuberculous etiology of the pelvic condition.

On abdominal examination bilateral tenderness in the lower quadrants is the rule. The tenderness is usually less marked than that with acute gonococcal or streptococcal infections and is more nearly of a severity such as is found with a residue of either gonococcal or streptococcal salpingitis. Occasionally, large tuberculous tubo-ovarian abscesses may be palpated through the lower abdominal wall. Signs of ascites are the strongest evidence obtainable in favor of the tuberculous nature of genital infections. It was present in one fifth of our cases. If fluid is found in the abdomen, then other causes of ascites must also be considered; chief among them is ovarian carcinoma which is almost always differentiated, relatively easily, by pelvic examination.

Vaginal examination is often helpful in making a diagnosis of tuberculosis, but all too often nothing distinctive can be seen or felt to make the diagnosis with certainty. The presence and the gross characteristics of leukorrhea are of little value in differentiating the types of salpingitis, since leukorrhea is the rule in all 3 types of the disease. The finding of gonococci in smear or their culture from the cervix almost certainly identifies the salpingitis; the failure to find them does not rule out neisserian tubal infection. Tubercle bacilli are found only occasionally in the cervical discharge when genital tuberculosis is present. The strongest single point obtainable on pelvic examination in favor of tuberculosis is a virginal outlet in the presence of obvious tubal inflammation. Evidence of recent or old infection of Skene's or Bartholin's glands favors the diagnosis of neisserian infection of the tubes. In genital tuberculosis the cervix usually appears normal, although sometimes a small ulcerative lesion can be seen, which on biopsy proves

to be tuberculous. Rarely, a widespread granulating cervical lesion extending to the vaginal vaults and looking much like extensive cervical cancer proves to be tuberculous. Reddening of the cervix is suggestive of acute gonococcal disease, and with streptococcal disease the soft patulous cervix often suggests a recent pregnancy. In streptococcal disease the recent pregnancy also may be responsible for enlargement of the uterus, whereas in tuberculous and neisserian pelvic infection the uterus shows little if any change in size. Limitation in motion of the uterus is common with all forms of pelvic inflammation. The fact that the diagnosis of tuberculous salpingitis is made correctly in such a small percentage of cases indicates that palpation of the adnexal region is not particularly distinctive for any type of tubal disease. When ascites is present, and the tubal inflammation purely serosal, the adnexal regions may feel entirely normal, or there may be only slight palpable thickening. In general, it is probably true that neisserian tubes are more grossly enlarged than tuberculous ones; however, we have seen enormous tuberculous tubo-ovarian abscesses, as well as abscesses in the cul-de-sac, which are indistinguishable from gonococcal abscesses. Marked nodularity of the tubes suggests tuberculosis, but gonococcal tubes can give rise to the same nodular feeling. Marked broad ligament thickening is a point against tuberculosis in favor of streptococcal pelvic inflammatory disease. On the whole, there is generally less acute tenderness on pelvic examination associated with tuberculosis than with other forms of pelvic inflammation.

It should be emphasized again that resistance to the ordinary measures instituted against pelvic inflammatory disease, such as bed rest, antibiotic therapy and diathermy, strongly suggest tuberculosis. In our experience in the wards where there are great numbers of patients suffering from pelvic infection, we have arrived at the correct diagnosis of the tuberculosis more often on the basis of this evidence than upon any other.

Finally, tuberculosis of the genital organs is being brought to light frequently today as the result of the examination of endometrial curettings, particularly when the curettage is done for sterility. Halbrecht of Tel Aviv, in a study of the endometrium of 820 sterile



women biopsied primarily to determine ovulation, found tuberculosis in 5.5 per cent. These were simple endometrial biopsies, and if complete curettage had been done the percentage undoubtedly would have been higher. In the patients with closed tubes exactly one third were found to have endometrial tuberculosis. Sharman of Glasgow found tuberculosis in 5 per cent of the biopsies done on sterile women, whereas Grant and MacKay found it in only 1 per cent in Australia. The highest incidence of endometrial tuberculosis was found in India, 8.5 per cent. From what we know of the pathology of this disease a very high percentage of these patients must have tubal tuberculosis. The cases reported from India revealed palpable evidence of adnexal inflammation in 32 per cent, but obviously the real incidence of tubal disease is much higher. The cases of endometrial tuberculosis without evidence of adnexal disease present a special problem in therapy which will be discussed later in this chapter.

### TREATMENT

The treatment of pelvic tuberculosis has changed considerably during the past several years due to two things: the use of anti-tuberculosis drugs and the relatively frequent finding of tuberculosis of the endometrium, chiefly as the result of curettage for the investigation of sterility. The relation of endometrial tuberculosis to disease of the tubes becomes very important in relation to therapy. Does tuberculosis of the endometrium invariably signify involvement of the tubes? Jameson, who has witnessed many autopsies on women dying of tuberculosis at Saranac, states that he never has seen tuberculosis of the endometrium without tubal involvement and does not believe that it exists. This statement is almost true but probably not completely so. There are a few cases on record of tuberculous endometritis in which thorough histologic examination of the tubes has failed to reveal any tubal involvement. There are many cases of tuberculous endometritis reported, discovered by curettage, in which there is no palpable evidence of tubal disease. For example, Sutherland found palpable adnexal enlargement in only 120 of 250 cases of tuberculous endometritis. This by no means indicates freedom from disease

of the tubes. The usual pathologic succession of events is involvement of the tubes, hematologically, from which the process extends to the endometrium. With pelvic peritonitis with ascites the tubes are involved when in many instances no palpable enlargement can be made out on pelvic examination. These pathologic facts must be considered when planning medical and surgical therapy.

From a standpoint of therapy the cases fall into 4 groups:

1. Cases diagnosed preoperatively with definite palpable adnexal enlargement.
2. Cases diagnosed as tuberculosis at the operating table.
3. Cases with ascites without palpable adnexal enlargement.
4. Cases in which a diagnosis of tuberculous endometritis is made from curettings without palpable adnexal enlargement.

Let us first consider those cases in which a firm diagnosis can be made preoperatively with definite adnexal enlargement. The diagnosis may have been confirmed by curettage and/or culture of the cervical secretions. In these cases therapy may be planned and consists of medicine and surgery. Although many cases of apparent cure have been reported after medical therapy alone, it is our belief that it is wise to remove the tuberculous focus surgically. Almost all of the patients with tuberculous salpingitis are sterile; therefore, little is to be gained by saving the tubes and the uterus. Prior to the use of streptomycin, surgery for genital tuberculosis carried with it a rather high mortality. In cases in which there were no large adnexal abscesses, no extensive peritonitis and without active tuberculosis elsewhere in the body the mortality was little if any greater than for operations for other chronic tubal infection. However, in the general run of cases the mortality was considerable. For example, Reuben Peterson reported an operative mortality of 7 per cent. Greenberg's report showed a hospital mortality of 7.6 per cent, and Jameson reported a primary mortality of 9.2 per cent on 961 cases collected from the literature.

These same three authors give an appraisal of the results of operative treatment. Reuben Peterson reports 73 per cent of his 100 cases as well, following operation. Greenberg was able to trace only 90 of his 200 cases,

since many of his patients were colored and belonged to the shifting population. Of the 90 cases traced he found 78 alive from 2 months to 30 years after operation. The general health of 73 of these had improved markedly after operation; 2 had improved slightly; and 3 had not shown any improvement. In a group of 961 cases of radical operation collected from the literature, Jamieson found a salvage rate of 72.2 per cent for the entire series.

Before considering surgery one should, of course, consider the disease from an extragenital point of view as well as the pelvis. This will often be a factor in determining the duration of medical therapy; indeed, at times extensive extrapelvic disease might deter one from doing surgery. Surgery is certainly safer today after medical treatment than it was before, and the risk is far less than that cited above. Also, the removal of the pelvic focus would seem to lessen the possibility of recurrence of the infection.

Medical treatment in the usual case consists of 1 Gm. of streptomycin per day and 3 Gm. of P.A.S. (para-aminosalicylic acid) 4 times daily. This regimen is continued for from 4 to 6 weeks, depending on response, and then surgery is done. Others prefer to give isonicotinic acid hydrazide (I.N.H.) 100 mg. t.i.d. over an extended period of time and reserve the streptomycin therapy for the time of operation. Medical treatment following surgery depends on the findings at operation. If there is no evidence of peritonitis, and if the operation seems to have done a clean and complete job, medical treatment may be discontinued. If diseased tissue is left behind in the form of peritonitis or abscess wall, the treatment should be continued after operation. The continued use of streptomycin over a prolonged period of time may give some concern because of possible side-effects. We have found that the dosage of 2 Gm. or more daily is apt to produce undesirable side-reactions. The most important of these is damage to the 8th cranial nerve. Vestibular dysfunction and, less frequently, loss of hearing occur. Skin reactions, kidney damage and eosinophilia may also be seen. On a dosage of 1 Gm. daily or less these reactions are infrequent. On this dosage therapy may be continued safely for 6 weeks, and on a dose

of 1 Gm. twice weekly for over a year. P.A.S. tends to delay or prevent the development of streptomycin-resistant strains of tubercle bacilli and for this reason it is wise to give it in conjunction with streptomycin. The unsuspected cases diagnosed as tuberculous at the operating table are treated surgically as indicated, followed by a course of streptomycin and P.A.S. or I.N.H.

The cases with ascites with palpable adnexal enlargement are treated medically, followed by surgery, but those cases with no discernible adnexal involvement have given rise to a difference of opinion. In the past we have failed to operate on some of these cases, believing that the tubal peritonitis represents so small a part of the peritoneal involvement that surgery could be of little value. We have seen such cases return after a year or two with large adnexal masses which proved to be fatal after attempted surgery. Therefore, we believe that the involved pelvic structures should be removed. Faulkner and Everett have shown that in all cases of tuberculous peritonitis the endosalpinx is involved, even when there is no tubal enlargement. Apparently, the endosalpingitis may progress even after the general peritonitis has subsided. Needless to say, medical treatment should be continued after operation.

Finally, we should consider the special problem which arises when tuberculous endometritis is discovered on microscopic examination of curettings or culture and bimanual examination reveals no evidence of disease. Most of these cases come to light in connection with sterility studies. Halbrecht of Israel has been particularly active in working on this form of the disease diagnosed by culture and/or endometrial biopsy. In 103 cases of latent genital tuberculosis in which both culture and endometrial biopsy were used, the cultures of the menstrual and the intermenstrual discharge gave positive results in 89.3 per cent, whereas the endometrial biopsy revealed endometrial tuberculosis in only 6.3 per cent. If complete curettage had been done rather than simple biopsy, undoubtedly the percentage of positive findings would have been greater. Confronted with such findings, what should the therapeutic plan be? If previous tubal insufflation has shown closed tubes, the chances

of childbearing are nil. One may assume correctly that tubal involvement is present, and one is justified in employing treatment medically and surgically as outlined above.

What should be done in those cases in which the tubes are patent? Patent tubes by no means rule out salpingitis; in fact, if the endometrium shows tubercles, the tubes are almost certainly involved and to the extent that pregnancy will not occur. Halbrecht has shown that the only full-term pregnancies which have followed antibiotic treatment for genital tuberculosis have occurred in patients in whom the disease was diagnosed and treated while still in the earliest tubal stage. Since the tubal lesions are no longer early when the endometrium is involved, Halbrecht believes that the only method of detecting pelvic tuberculosis when it is still possible to treat it medically with the hope of future pregnancy is by culture.

### CHOICE OF OPERATIONS

When tuberculous tubes are recognized at the operating table, the minimum amount of surgery permissible is bilateral salpingectomy. Since the disease is practically always bilateral, preservation of one tube is rarely, if ever, justifiable. When tempted to save one tube it should be remembered that conception rarely occurs after nonsurgical "cure" of tuberculous salpingitis. In young women the operation of choice is bilateral salpingectomy and, in most instances, hysterectomy with preservation of one ovary. It is probable that in some cases, in which the uterus is saved, the uterine infection heals after removing the tubal focus, and it is certain that in many of these individuals the retained uterus gives no further trouble. However, this is a rather weak argument in favor of saving this useless organ when the object of the operation is eradication of the pelvic focus, and since 72.6 per cent of the uteri removed in Greenberg's series proved to be infected. Total hysterectomy is desirable, for we have seen the disease persist in the cervix after a subtotal operation. However, there are occasional cases in which the cervix and the rectum are cemented together with a caseous process in which the risk of rectal injury exceeds the benefit of removing the cervix. As indicated in the discussion on pathology, the ovaries are relatively resistant

to the infection. The peri-oophoritis usually clears up quite satisfactorily after removal of the neighboring diseased tube. When there is marked involvement of the ovaries, as in bilateral tubo-ovarian abscess, hysterectomy and bilateral salpingo-oophorectomy must be done, regardless of the youth of the patient.

The older the patient, the lighter the indications should be for radical pelvic surgery. In the thirties we frequently are forced to perform the radical operation, but we believe that the preservation of a relatively normal ovary is often desirable. After 40 it is our rule to perform the radical operation in all cases of tuberculous salpingitis. The statistics found in the literature show that on the whole the results are better with radical than with conservative surgery. Reuben Peterson, for example, reported that 73 per cent of all of his cases were well after operation, whereas 77.3 per cent of the cases upon which the radical operation was performed were well, in spite of the fact that in the radical group there was a higher percentage of cases with chest involvement.

Occasionally, at operation one encounters a case of the dry type of peritonitis in which countless adhesions between loops of tuberculous bowel make it impossible to separate them sufficiently to expose the pelvic organs. To persist in the dissection can result only in tearing the caseated bowel wall. This almost certainly will result in a fistula which probably will not close. In these rare cases discretion is the better part of valor, and it is wise to back out, close the abdomen and rely on medical therapy. Very rarely have we punctured a tuberculous cul-de-sac abscess as an adjunct to medical treatment.

Drainage of the abdomen should be avoided. Fifty-two per cent of Greenberg's cases were drained. This is a much higher percentage of cases than anyone would consider draining today, but one must remember that his cases date back as far as 50 years from today, and our ideas of drainage have changed markedly. However, these reported cases teach us a valuable lesson. Of the 104 cases drained, 18 developed fecal fistulas. None of those closed without drainage developed fecal fistulas. In our opinion the only indication for drainage in these cases is injury to the bowel which cannot be repaired satisfactorily or perhaps, rarely, when a por-

tion of necrotic abscess wall cannot be removed safely.

In those cases of tuberculosis of the genital organs in which the diagnosis is made only postoperatively, the problem may arise as to the proper procedure, if the operation performed was more conservative than the operator would have performed had the nature of the infection been recognized at the operating table. We never have found it necessary to do more complete surgery in such instances. The knowledge of the exact nature of the infection gained by microscopic examination is helpful in prescribing post-operative medical treatment.

Finally, there is a problem that arises from the diagnosis of tuberculosis of the cervix in a biopsied cervical lesion. If the cervical le-

sion is extensive, there will be, in almost all cases, clinical evidence of tubal tuberculosis. Radical pelvic surgery is not feasible when an extensive cervical lesion has extended to the vaginal vaults. Such a case should be treated with prolonged streptomycin and para-aminosalicylic acid. We have under observation at present a case in which a very large tuberculous lesion, indistinguishable clinically from an advanced cervical carcinoma, appears to be healing under 1 Gm. of streptomycin twice weekly. At the moment it seems possible that healing may progress to the point where surgery may be feasible. When the cervical lesion is small, the patient should be treated with streptomycin and para-aminosalicylic acid and then operated upon.

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# Sterility

## GENERAL CONSIDERATIONS

Although this chapter is concerned with operative measures designed to overcome sterility in the female, it is difficult to discuss this phase of the subject without first emphasizing certain diagnostic and nonoperative therapeutic measures that should be carried out before surgery is considered. Operations performed primarily for the relief of sterility never should be done unless both husband and wife have been studied thoroughly and all possible nonoperative corrective measures executed. Unfortunately, this is not always done today. It is a not uncommon experience for a patient, complaining solely of sterility, to tell her gynecologist that a uterine suspension has been advised without tubal insufflation or examination of the husband.

A study of sterility should start with a complete history. This should be more comprehensive than the usual gynecologic history. It should include a search for evidence of constitutional diseases, such as diabetes, tuberculosis, alcoholism and obesity, any of which may be a factor in infertility. It should also include a search for evidence of an endocrinopathy on the part of the husband or the wife, with particular reference to hyperthyroidism and hypothyroidism and pituitary infantilism. An exact and complete menstrual history is of great importance, bearing in mind the possibility of constitutional as well as local disease being responsible for a menstrual irregularity. In evaluating the menstrual history, it should be remembered that regular monthly bleeding is possible without ovulation and, conversely, very irregular periods may be associated with ovulation. The history should also include a careful inquiry into dietary and marital habits. Special inquiry should be made re-

garding symptoms suggestive of pelvic infection in the recent or remote past. This includes a search for evidence of abortions, induced or spontaneous, neisserian infection and acute appendicitis. Facts concerning premarital and extramarital sexual activity should be tactfully obtained from the patient. If, for example, the female admits repeated exposures to different males, without contraception and without pregnancy, the suspicion is strong that she is sterile, and the likelihood that it is due to neisserian tubal disease is great.

After having taken the history of the female privately, a talk with the husband often reveals pertinent facts. Evidence of epididymitis or mumps orchitis should be sought for. In addition, information regarding premarital or extramarital exposure is of value. A history of promiscuity not only suggests the likelihood of venereal infection, but if promiscuity is admitted without contraception and without impregnation of the sexual partner, the likelihood of male sterility is great. It should not be lost sight of that, although the male is responsible directly for about one third of the cases of sterility, he is indirectly responsible for a much larger percentage due to transmission of infection to the wife. Occasionally, one obtains a history from the male of malformation of the sexual organ, or inability to perform the sexual act, so that he is unable to deposit the sperm in the vagina. In such cases artificial insemination may be carried out, often with success. Whenever there is evidence of disease of the male sex organs, the husband should be referred to a urologist for study and treatment, if indicated.

The history being complete, the wife is given a thorough physical examination with special reference to endocrine or constitu-

tional diseases, the state of nutrition and the condition of the generative organs. Although the relation of nutrition to sterility never has been established on a scientific basis, the clinical fact is indisputable that the incidence of pregnancy is greater in normally nourished women than in the obese or the undernourished.

The bimanual pelvic examination often reveals valuable, relevant data. The vagina is rarely a factor in sterility, unless it is congenitally absent, a fact which is discovered earlier in life. Vaginitis may interfere with coitus, but this is a temporary state and of no real importance in the failure to conceive. The cervix may play a major role in sterility, because of its congenital form, because of infection or as a result of operative procedures. Congenital stenosis cannot be detected with certainty, except by attempting cervical dilatation, and it is difficult to evaluate its role in failure to conceive. Nevertheless, there is no doubt, clinically, that certain women become pregnant following cervical dilatation after a long period of sterility.

Chronic cervicitis, producing a tenacious mucopurulent discharge which fills the cervical canal, would seem to offer an effective barrier to ascent of the sperm, and some women conceive after the chronic infection has been cleared up. On the other hand, it is remarkable that some women conceive in the face of profuse cervical leukorrhea. Strictures resulting from infection, cauterization, conization or amputation may be an obstacle to easy ascent of the sperm.

The body of the uterus should be palpated carefully as to position and form. Retroversion is much more of a factor in spontaneous abortions at 3 or 4 months than in sterility. In fact, it is doubtful whether it is ever responsible for failure to conceive. Myoma may be directly responsible for sterility, and every gynecologist of experience with myomectomy has had the gratifying experience of witnessing prompt pregnancy following myomectomy.

Infection of the fallopian tubes is the greatest cause of sterility. Hence, in the bimanual examination, the adnexa should be palpated with the greatest of care. Gonorrheal infection is much more apt to result in closed tubes than is postabortive or puerperal

infection, but the latter two infections may occlude the tubes, as may tuberculosis. Thickening in the adnexal region of even a minimal degree should make one suspicious of old tubal disease, but perhaps the most delicate test by palpation is for mobility of the ovaries. It should be remembered that there may be complete occlusion of the tubes from salpingitis without the slightest palpable evidence of adnexal disease.

Gross disease of the ovaries, such as neoplastic cysts and endometriosis, may be the cause of sterility and may be apprehended by bimanual examination, but in most instances it is quite impossible to judge ovarian function by palpation. Periovarian adhesions may so encase the ovary as to prevent freeing of the ovum into the peritoneal cavity. A thin-walled, small cyst suggests a corpus luteum or follicular retention cyst that may be responsible for suspension of the normal ovarian cycle, but an ovary may feel quite normal on bimanual examination and yet it may be quite abnormal in function. When one considers the fact that not only must the ovary produce an ovum but also a normal ovum, one becomes aware of the shortcomings of palpation in evaluating ovarian function.

Having completed the physical examination, it is our custom to perform a Huhner test. The couple is instructed to have intercourse, and the wife presents herself at the office within an hour. Through a duckbilled speculum specimens of semen are taken from the vaginal pool and the cervical canal. The finding of great numbers of motile sperm in these locations is the best possible evidence of the male's ability to produce motile sperm in quantity that can survive in the environs of the wife's vagina and cervix. It is true that a motile sperm is not necessarily a potent one, and it is also true that if all the sperm seen are nonmotile, there is still the possibility that some motile sperm have already ascended into the uterus. The literature is filled with reports of work on sperm counts and sperm forms, but the significance of subnormal counts and abnormal forms is not clear. One authority goes so far as to say that he never has seen a pregnancy result when the sperm count is below 60,000,000 per cc. This does not agree with our experience.

Hetchkiss, who studied the sperm of husbands whose wives were pregnant, noted counts as low as 2,250,000 per cc. As a matter of fact, one of the striking things seen in doing great numbers of Huhner tests is the tremendous variation in the number of sperm in different semen specimens from the same man. However, when few or no sperm are found at the Huhner test, or when only nonmotile sperm are found, it is our custom to refer the male to a urologist for study. As a rule, the results of the urologist's therapy are not very helpful. If repeated Huhner tests show only nonmotile sperm, it is our custom to ask the patient to use a douche of a tablespoonful of soda bicarbonate in a quart of water before coitus. In many cases one will find the hitherto nonmotile sperm to be actively motile. We have seen this result so many times that we are certain that it is dependent upon the alkalinity of the vagina and is not a coincidence.

Having become satisfied that the male is normal and that no condition is present that would indicate absolute sterility, the next step in the investigation is to determine the patency of the fallopian tubes and to perform a premenstrual curettage to determine whether or not ovulation has taken place. These tests should be done 2 or 3 days before the expected date of menstruation. When periods are regular, it is simple to estimate this time, but when the periods are irregular, one can only attempt to hit upon the premenstrual time. Under Pentothal Sodium anesthesia, the tubal insufflation is first done, then the cervix is well dilated, and the uterine cavity is curetted.

Our practice of performing tubal insufflation close to the expected period has been questioned by some. One argument used against this practice is that insufflation done so close to menstruation might result in blowing particles of endometrium about to be



FIG. 322. Premenstrual secretory endometrium.

shed through the tubes and thus producing endometriosis. Our only reply to this objection is that having done thousands of Rubin's tests at this time of the cycle, we never have observed a case of endometriosis to follow. Another objection raised is that the premenstrual swelling of the endometrium might result in falsely negative results when the tubes are actually open at other times of the month. We have not observed this to be the case. It is true that on rare occasions we have failed to get gas through the tubes premenstrually, and at subsequent tests, at other phases of the cycle, gas has passed through. But, on the other hand, we have also had the reverse of this experience. In interpreting results with the Rubin's test it is important to remember that occasionally negative results are obtained that cannot be explained. As evidence of this most gynecologists experienced with the test have observed pregnancy follow repeatedly negative tests.

Subsequent Rubin's tests done for therapy are usually done about the 10th day of the cycle.

The endometrium obtained by premenstrual curettage is studied microscopically to determine whether or not ovulation has taken place. Typical premenstrual secretory endometrium indicates progesterone activity which, in turn, indicates the presence of a corpus luteum which has followed ovulation (Fig. 322). Nonsecretory endometrium of the interval (Fig. 323) or hyperplastic (Fig. 324) type indicates an absence of the corpus luteum and, hence, an absence of ovulation. It is encouraging to the patient to tell her that she is ovulating, and it is equally discouraging to tell her that no evidence of ovulation was found. However, it should be borne in mind that the endometrium is a record of ovarian function of the current month only, and it is well known that women may change spontaneously from ovulatory to nonovulatory cycles and vice versa. When no evidence of ovulation is found, one naturally seeks a hormone that will stimulate ovulation. It must be admitted that there is no evidence that any hormonal therapy will induce a woman to ovulate who would not have done so spontaneously. The work of

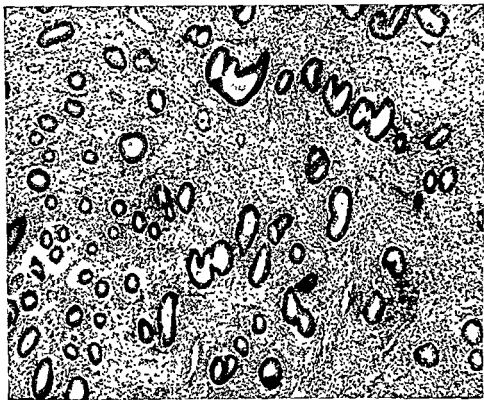


FIG. 323. Nonsecretory endometrium, interval type.



Davis and Koff, which was at first accepted and seemed to indicate that ovulation could be induced by injection of the gonadotropic hormone from the serum of pregnant mares, has not been substantiated by subsequent investigators.

Hysterosalpingography is not used in our clinic in the investigation of sterility as frequently as in some. In most cases it is of no more value than the much simpler Rubin's test, and iodized oil, which is commonly used, has been shown to have an irritating effect on the tubes in some instances. The solution proposed by Titus and his co-workers of 40 per cent Skiodan with 20 per cent acacia is less irritating and is preferable to iodized oil. We have reserved the use of hysterosalpingography in relation to sterility for those rare cases in which it is desirable to locate the point of obstruction when a plastic operation on the tubes is contemplated and when double or septate uterus is suspected.

Basal metabolism tests on both husband and wife are indicated on the slightest clinical evidence of thyroid dysfunction. Determinations of estrogenic and gonadotropic hormone content of the blood and the urine

have proved to be of little value. There is still much confusion as to the significance of the results. There is little use in making pregnanediol determinations, for the endometrial biopsy gives the best indication of corpus luteum activity.

### OPERATIVE TREATMENT

Before turning to the various operative procedures which are sometimes indicated in sterility, the therapeutic aspects of uterotubal insufflation should be considered. It is the author's belief that this procedure is more productive of results than the combination of all the major operative procedures.

Dilatation of the cervix is done routinely in connection with the Rubin's test. It is our belief that this is of value in some cases. This opinion is based on the experience of older gynecologists who not infrequently witnessed pregnancy take place promptly following a dilatation and curettage after many years of infertile mating. Likewise, simple uterine sounding as practiced a generation ago was sometimes followed by pregnancy after a long period of sterility.

Rubin was of the opinion that the simple

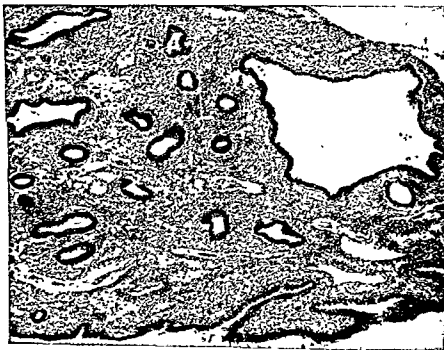


FIG. 324. Hyperplasia of endometrium.

removal of a mucous plug from the cervix in the course of performing a tubal insufflation might be an important factor in relieving sterility in some cases.

The most important therapeutic effect of insufflation is its effect on the tubes. Mild intratubal agglutinations may be separated, mucous plugs in the tubes may be dislodged, and adhesions at the fimbriated ends may be broken. Peterson and Cron observed the closed tubes at laparotomy during insufflation with 200 mm. or more of pressure. They witnessed the rupture of adhesions or the rupture of the weakest portion of the tube and noted enlargement of such openings by the continual escape of gas. They suggested the advisability of using pressure up to 300 mm. Hg with the abdomen open. It is our opinion that raising of the pressure well over the usual 200 mm. Hg is justifiable when the abdomen is open so that any damage resulting from this excessive pressure could be repaired promptly. However, in none of their cases in which they so overcame tubal obstruction did they observe appreciable hemorrhage. Rubin has opened previously ligated tubes at a pressure of 167 mm. Hg. Pressures of over 200 mm. never should be used with air, as there exists the possibility of air embolism. In fact, we have used only carbon dioxide for all tubal insufflation.

The therapeutic effect of repeated Rubin's tests is best evaluated by Rubin, who has had such a large experience that the element of chance has been reduced to a minimum. In his personal series there were 2,014 patients in the group of primary sterility. Of these, 17.7 per cent became pregnant. There were 1,186 patients with secondary sterility of whom 19.5 per cent became pregnant. The majority (61.86%) of his patients had been married over 3 years, and many had been married 10 years or longer. The therapeutic effect of insufflation was particularly noteworthy in 118 of Rubin's cases of strictured tubes. Of these cases 31 per cent eventually became pregnant as against 26 per cent of the cases with normally patent tubes. The time of pregnancy in relation to insufflation gives some idea as to the benefit of the Rubin's test. Within 2 months of the test 38 per cent of the successful women were gravid; 64 per cent of the pregnancies occurred

within 6 months, and 18 per cent more of the pregnancies occurred in the following 6 months. These results are extremely suggestive that there is real therapeutic value in tubal insufflation, especially since in many instances pregnancy followed upon improvement in the tubal status as demonstrated by repeated insufflations.

Considering the above results of Rubin, one certainly should exhaust the possibilities of insufflation therapy before considering major surgery for relief of sterility.

The following procedures, major and minor, are at times indicated in the treatment of sterility:

*Cervical cauterization* is done to clear up tenacious mucopurulent discharge in cases of sterility, and the results are often gratifying. The technic of and the postoperative care following this operation are described in Chapter 19, "Nonmalignant Cervical Lesions and Their Treatment."

*Myomectomy* is, at times, justifiable for the relief of sterility alone. The best of judgment is often required in making the decision of whether to perform myomectomy before pregnancy is attempted or to attempt pregnancy in the presence of the fibroids. When pregnancy has been attempted for a reasonable time and conception has failed to take place, the decision to remove the fibroids, if they are of considerable size, is easily made, and the results frequently justify the operation.

*Pelvic laparotomy* for relief of sterility, when the cause is known to be tubal disease, may be undertaken primarily for that purpose, or operative correction of the sterility may be incidental with a pelvic operation done primarily for relief of other symptoms. Many procedures have been described, but most of them may be grouped into 4 types:

1. Release of adhesions about the tubes or fimbriated ends—salpingolysis.
2. Resection of the proximal portion of the tube and implantation of the distal portion into the uterine cornu.
3. Making of a new opening in the occluded tubal end—salpingostomy.
4. Implantation of the ovary or a part of the ovary attached to its pedicle into the uterus.

In general, when operation is done for

symptomatic chronic salpingitis, a bilateral salpingostomy is almost always indicated. Occasionally, one encounters marked disease of one tube and only slight adhesions about the other. This is more apt to be the case when one is dealing with the residue of a puerperal or postabortive infection than when the disease is of gonococcal origin. The simple release of adhesions about the tube or the fimbriated extremity may reveal a patent tube, when tested with a Chetwood syringe. When the clinical evidence points to a neisserian infection as the cause of tubal closure, one is seldom justified in opening the abdomen with the intention of opening up the tubes by simple release of peritubal adhesions. In that type of infection, the disease is primarily an endosalpingitis and, even though the peritubal adhesions are released, the lumen is apt to be occluded. When the history clearly indicates a postabortive or puerperal infection, or when the original infection was secondary to a ruptured appendix or pneumococcus peritonitis, at times one may be justified in considering the freeing of peritubal adhesions for relief of sterility.

Re-implantation of the distal portion of the resected tube into the uterine cornu and/or salpingostomy are practiced frequently by some gynecologists, rarely by others, and never by many. The divergence of opinion regarding these two procedures is well illustrated in an article by Greenhill who sent questionnaires to a large number of leading gynecologists and obstetricians in this country. Of the 107 answering the questionnaire 56 per cent condemned both salpingostomy and tubal implantation; 50 per cent admitted that they never had done a salpingostomy; and 82.2 per cent never had re-implanted a shortened tube into the uterine cornu. The actual results reported by this representative group of American gynecologists indicate the reason for the lack of enthusiasm by such a large percentage. Out of a total of 818 operations (number partially estimated) there was a total of 54 pregnancies. This equals 6.6 per cent, or 1 pregnancy in 15 operations. Among the 54 pregnancies, there were 36 term babies, making a total of 4.4 per cent, or 1 live baby for 22.5 operations. Eighteen and a half per cent of the pregnancies terminated

in abortions; 14.8 per cent were tubal pregnancies; and 66 per cent resulted in live babies. In reviewing the results of these operative procedures, it is evident that a rather high percentage of the women had patent tubes as judged by the Rubin's test following operation. The low incidence of pregnancy indicates that patent tubes give no assurance of subsequent pregnancy. It is probable that the changes in the endosalpinx, due to the disease, are not favorable to conduction of the ovum down the oviducts.

Attempts to restore fertility after salpingectomy, by means of implanting the pedicled ovary into the uterine cavity, were first made by Tuffier of Paris. He implanted the whole ovary through a mid-line incision in the posterior wall of the uterus. The few pregnancies resulting from this almost always ended in abortion, and in some instances the uterus gave birth to the implanted ovary.

This procedure has been almost universally abandoned. When implantation is done today, the majority of operators follow the technic described by Estes, or some modification of it. Estes recommends excision of the convex surface of the ovary and implantation of the remainder into the uterine cornu in an opening made in the myometrium, communicating with the cavity. It seems illogical to us to excise the cortex of the ovary, since in this portion most of the follicles occur. In the few instances in which we have performed this operation, we have implanted the whole ovary. Estes has reported 50 cases in which he has performed this operation and in which he has complete case records. Four of the 50, or 8 per cent, became pregnant; 2 of these went to term, making a percentage of success of 4. Von Graff collected 41 cases from the literature in which the ovary was transplanted into the uterine cavity. There were 3 pregnancies, an incidence of 7.5 per cent. One of the 3 went to term, making an incidence of live births of 2.5 per cent. Reiprich collected 200 cases of ovarian transplants of all types, 2.5 per cent of which became pregnant. Although operations of the Estes type result in a low percentage of successes, it must be said in its defense that, in many instances, the operation is incidental to a salpingectomy, and that the abdomen is opened primarily for relief of pain. The ne-

cessity of another laparotomy for removal of a cystic ovary, implanted at the uterine cornu, probably occurs no more frequently than after salpingectomy in general.

From the above discussion and statistics, it is obvious that the chances for full-term pregnancy following various plastic procedures are in the neighborhood of 2.4 to 4.4 per cent. In view of this, one is not justified in urging the undertaking of a laparotomy for the relief of sterility. Not infrequently, however, it is not a case of urging that the operation be done; it is the woman who urges the surgeon to undertake it. It is our belief that one never is justified in undertaking the task without having attempted to

discourage the patient by a frank statement of the low incidence of success. If, after the patient is acquainted with these deterrent facts, she still insists upon a laparotomy, one is justified in doing it, if the pelvic findings are such as to suggest a reasonable chance of carrying out one of the above procedures. If this plan is followed, no gynecologist will perform more than an occasional laparotomy that is undertaken for the relief of sterility.

#### TECHNIC: RE-IMPLANTATION OF DISTAL PORTION OF TUBE INTO UTERUS

The obstructed proximal end of the tube is excised. The remaining distal portion is tested for patency with a Chetwood syringe,

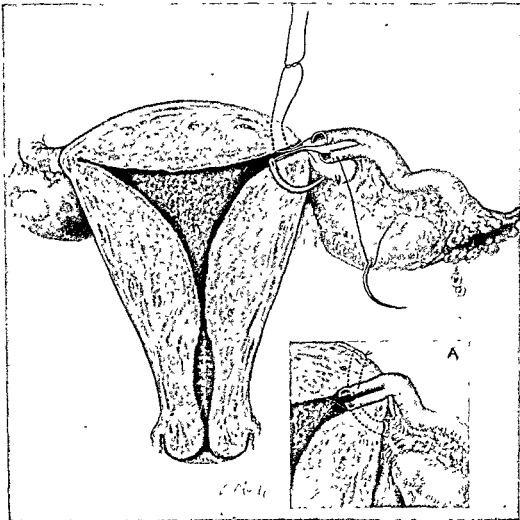


FIG. 325. Implantation of a shortened tube into the uterus. The split tube is drawn into the uterine cavity through an opening at the cornu. Inset A shows tube sutured in the cornu.

using either air or salt solution. A small wedge-shaped piece of tissue is excised at the cornu, sufficient to permit the insertion of the tube into the uterine cavity. The uterine end of the shortened tube is split longitudinally for about a centimeter or slightly less. Using No. 00 chromic catgut, a bite is taken into each half of the split end. Each end of both sutures is then threaded on a curved needle. The needle is inserted through the cornual opening and carried out through the myometrium (Fig. 325). After the four ends of the two sutures have been brought out through the uterine wall, the two ends attached to each flap are tied together. Thus the end of the tube is drawn into the uterine cavity and, since it is split, the lumen is more apt to be kept open at the point of implantation (Fig. 325 A). In recent years we have used a small polyethylene tube within the fallopian tube and extending into the uterine cavity. The distal end of the polyethylene tube is brought out of the abdomen through the incision and is withdrawn after 2 weeks. Overstreet has suggested bringing the tubing out laterally to the incision, threading it

through a needle which perforates the abdominal wall as shown in Figure 326. Polyethylene tubing has been shown to be completely inert in its effect on the tissues of laboratory animals, and the frequency with which we have found the tubes to be patent following its use in plastic tubal operations indicates that it is equally innocuous in the human tube. Tubal insufflation should be done after about 6 weeks to test the patency of the implanted tube.

#### TECHNIC: CUFF SALPINGOSTOMY (SOVAK'S METHOD)

The tube is carefully freed from its adherent bed, and no instruments are used in handling it to avoid injury to its delicate tissue. The distal portion of the tube is excised proximal to the point of obstruction (Fig. 327 a). The patency of the tube is then tested with a Chetwood syringe. If the tube is open, a gurgling sound can be heard as the air enters the uterine cavity, and the uterus can be felt to vibrate as it is held. If the tube is obstructed at a point close to the uterus, the failure of gas to pass will become

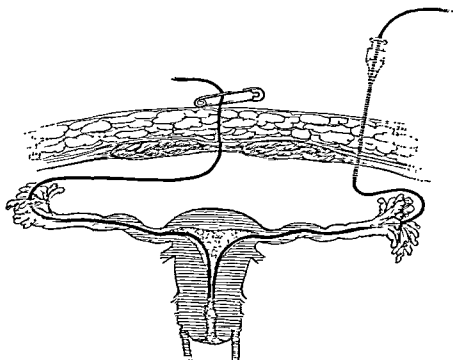


FIG. 326. Showing method of bringing tubing out through mid-line incision or laterally through needle which is then withdrawn.

apparent. If the remaining portion of the tube is found to be patent, the Chetwood syringe is inserted again, and a circular cut is made through the musculature of the tube about 1.5 cm. from the end (Fig. 327 b). A French urethral catheter is then passed into the tubal lumen for at least 3 cm. A Bonney clamp is placed over the tube con-

taining the catheter so that the tip of the clamp is just within the circular incision. Two Allis clamps are used to grasp the ends of the tube. The tube is pulled backward, and at the same time the Bonney clamp is pushed forward (Fig. 327 c). Thus a cuff is formed at the end of the shortened tube. The cuff is held in place by a few delicately

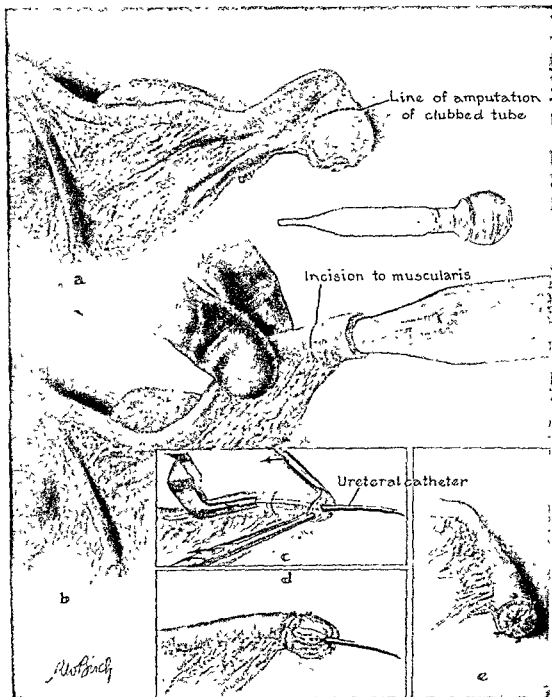


FIG. 327. Cuff salpingostomy (Sovak Method). (a) Line of amputation of clubbed tube. (b) Circular incision into muscularis. (c) Cuff is reflected. (d) Cuff is sutured to serosa. (e) Newly formed end of tube.

placed sutures of No. 000 chromic catgut (Fig. 327 d and e). The Bonney clamp is then released, and the catheter is withdrawn. The fallopian tube is then catheterized with

fine polyethylene tubing which passes into the uterine cavity, and the distal end of the polyethylene tubing is brought out through the abdominal incision. It is desirable to sus-

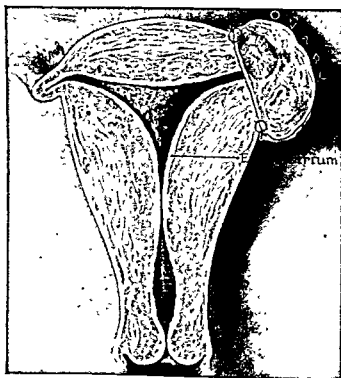
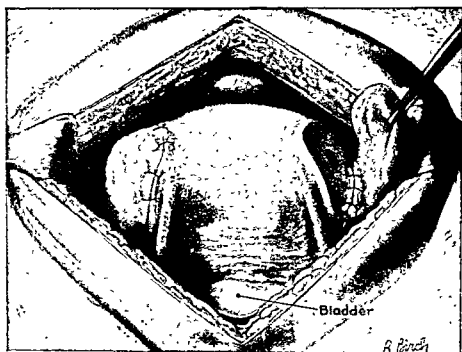


FIG. 328. Estes operation for sterility after salpingectomy. (Top) Excision of myometrium at the cornua opens the uterine cavity. The right ovary has been sutured to the cornu. The left is being sutured in place. (Left) Section of the uterus showing how ovulation into the uterine cavity is possible.

pend the tube to the side of the pelvic wall to prevent the end from becoming adherent in the cul-de-sac. An insufflation is done after 6 weeks to test the patency of the tube.

#### TECHNIC: MODIFIED ESTES METHOD OF IMPLANTING OVARY INTO UTERINE CORNU

The operation may be done at the time of salpingectomy or at a later time. In either case the ovary, which is apt to be somewhat adherent in the cases in which the operation is indicated, is mobilized sufficiently to be drawn up to the uterine cornu. The operation may be done bilaterally or unilaterally, depending on the conditions.

Enough of the uterine cornu is excised to produce an opening in the uterine cavity of approximately a centimeter. In the Estes operation, as originally described, a slice of ovarian cortex is removed before the ovary is attached at the cornu. This never has seemed to us to be a rational procedure, since it is the cortex where the follicles are found, and slicing away part of it would seem to reduce greatly the chances of ovulation into the uterine cavity. Hence, the whole ovary is swung against the cornu with a portion of the cortical surface opposite the opening into the uterine cavity. It is sutured in place by several interrupted sutures of No. 00 chromic catgut (Fig. 328).

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# Hysterography and Hysterosalpingography

## HISTORY

Since Rindfleisch first visualized the uterus roentgenographically in 1910 by filling the uterine cavity with bismuth paste there have been many attempts at improving the technique and the safety of hysterography and hysterosalpingography. Most of these have been concerned with the development of an opaque medium which would give a sharp picture and at the same time not be irritating to the tubal mucosa and the peritoneum. In 1914 Cary and Rubin worked with collargol but found it irritating and unsatisfactory. Lipiodol made its appearance in 1922, and, following this, uterosalpingography attained some degree of popularity. Following its rather extensive use, complications were reported which caused its popularity to wane. Intravasation of the dye into the veins was reported frequently, and in rare instances pulmonary embolism was found. It is obvious that Lipiodol should not be injected with excessively high pressure, during menstruation or directly after a curettage. In spite of heeding these precautions, the complications of intravasation and embolism have occurred occasionally. In addition, not infrequently fat granulomas formed in the tubes and the peritoneal cavity. Their presence has been demonstrated at surgery in several instances. Likewise, smoldering bacterial pelvic infections were occasionally lighted up, and in a few instances a chemical peritonitis resulted from the dye. In spite of these complications Robins, who had a rather large experience with Lipiodol, concluded that it was stable, nonirritating, nontoxic and was the medium of choice. Rubin, on the other hand, decided that the complications did not justify the use of Lipiodol.

A search continued for a more suitable substance, and Titus and his associates ex-

perimented with Skiodan. The substance, as such, was found to have too little viscosity for visualization and proper handling. Finally, after several trials and errors on rabbits they concluded that a mixture of 40 per cent Skiodan and 20 per cent acacia was nonirritating and they used it successfully in humans.

Rubin, in 1941, introduced Visco-rayopaque, but it was found to be so irritating to the peritoneal cavity that it has been abandoned. A similar drug, Rayopake, was found much less irritating. Rayopake has recently been taffed off the market, but fortunately a similar aqueous solution has become available. Xumbradil Viscous H., manufactured by a Swedish firm, seems to be nonirritating and a satisfactory contrast medium. Xumbradil and Skiodan acacia are quickly absorbed and excreted, thus obviating the danger of foreign-body reaction and embolism.

Before considering the indications for hysterosalpingography it is necessary to form an opinion regarding the frequency and the severity of the complications. It is a procedure which gives us certain information in cases of sterility and a few other conditions, but in many instances practically the same information can be obtained by other means. Therefore, it behooves us to weigh the advantages and the disadvantages of the procedure.

## ACCURACY OF DIAGNOSIS

There is only one recent article in the literature on the accuracy of hysterosalpingographic diagnosis, an article long overdue. In order to evaluate any procedure one should consider carefully the diagnostic accuracy of the procedure as well as its possible dangers. Sweeney has recently made a survey of the latest 1,000 hysterosalpingograms made at the New York Hospital,

checking the accuracy of diagnosis. Of the hysterosalpingograms 410 were interpreted as normal, whereas 578 considered as abnormal. Of these, 218 were admitted to the hospital for operation, thus enabling Sweeney to check the roentgenologic diagnosis. The operations which were done were abdominal hysterectomy, vaginal hysterectomy, hysterotomy, myomectomy, uterine unification and curettage. In 55.2 per cent the x-ray diagnosis was not confirmed; in 35.6 per cent the diagnosis was confirmed; and in 10.5 per cent the confirmation was equivocal. The results in the diagnosis of submucous myoma are particularly interesting, because it is to establish or rule out this condition that hysteroscopy is thought to be particularly useful and accurate. The diagnosis of submucous myoma was made 122 times, but this diagnosis was erroneous in 59 per cent. The diagnosis of endometrial polyp was made on 32 occasions but was in error 78.1 per cent of the times. In addition, endometrial polyps were found in 5 instances when it was not suspected by x-ray examination. Some articles in the literature have claimed usefulness and accuracy with hysteroscopy in diagnosing adenomyosis, but the careful check of Sweeney showed that in 15 cases in which adenomyosis was proven pathologically the roentgenogram gave no hint of its presence. Adenomyosis was diagnosed 3 times by x-ray examination and was shown not to be present in any of these cases.

In view of these findings by Sweeney we can express our views on hysterosalpingography no better than those of the author of this paper:

It is felt that hysterosalpingography should be accepted as an ancillary diagnostic procedure which has a limited percentage of accuracy. We firmly believe that the individual using these x-rays should consider carefully in each instance the value of the information to be gained by their use before exposing a patient to the procedure, particularly since the region to be examined contains the gonads.

### COMPLICATIONS

The complications resulting from hysterosalpingography, based on a review of 2,500 cases by Marshak and his associates, have been divided into two groups: those due to

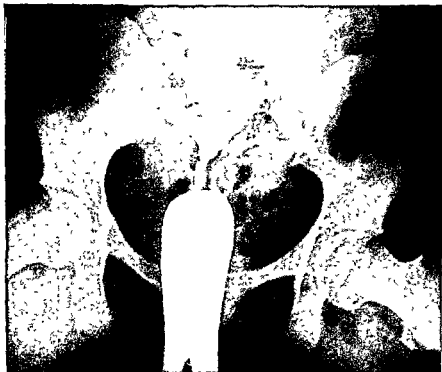
the contrast media and those due to the procedure. Those due to the contrast media were found to be as follows:

Pain was present in some degree in 80 per cent of the patients. It varied from slight pain for a few moments to rather severe pain for several hours. It was present only in those cases in which the dye entered the peritoneal cavity. There was less pain with Lipiodol and slightly more with Skiodan and acacia and with Rayopaque.

Peritonitis was indicated in those patients who experienced severe prolonged pain. These patients developed abdominal rigidity, tenderness, vomiting and fever, indicating a chemical peritonitis. These symptoms occurred in 14 or 1,014 patients in whom the dye entered the peritoneal cavity and occurred regardless of the media used. Schultze reported 200 laparotomies done from 1 to 60 days after salpingography. In every case he found a residue of the oil in the form of a film over the pelvic peritoneum and in the folds of the abdominal peritoneum. There were no adhesions, but in 7 cases there were yellowish plaques with evidence of fresh tissue changes on the posterior surface of the uterus, the broad ligament and in the folds of the abdominal peritoneum. Lash performed a laparotomy on a patient 22 months after salpingography and found dense adhesions from the omentum to the parietal peritoneum and to the pelvic organs. There were several cystic masses containing a clear, amber, oily fluid, and foreign-body giant cells were present. There are many other reports in the literature of injury to the tubes and the peritoneum. For example, Reichle and Rottger reported 19 cases in which injury followed the injection of iodized oil. Four patients developed granulomatous inflammation of the tubes with irreparable damage, while the others developed a peculiar type of tubal inflammation characterized by oil deposits. There are many reports in the literature to indicate that oil trapped in an occluded tube is retained almost indefinitely and often dooms the tube to permanent occlusion.

Endometritis was observed in 8 of Marshak's cases among 450 uteri which were removed from 1 day to 1 week after the injection of the dye. All of these had been

FIG. 330. Hystero-gram of a bicornuate uterus. The right horn is rudimentary.



presence of unsuspected pregnancy twice. In both instances the pregnancy went on to term.

### INDICATIONS

From this short survey it is obvious that the complications described are of sufficient frequency and severity to cause one to consider the procedure as not entirely harmless. It is, for example, a more formidable procedure than tubal insufflation with carbon dioxide. Hence, one should be able to foresee a definite possibility of diagnostic or therapeutic benefit from the procedure before undertaking it. One should also not put a patient through hysterosalpingography if practically the same information can be obtained by a safer means. There is great difference of opinion among gynecologists as to the indications for hysterosalpingography. It is a daily procedure in some clinics and one used only rarely in others. For example, certain gynecologists of the French school carry it out routinely in all cases of functional bleeding. It has appeared to us that their attitude is one of avoiding the simple and sure procedure of curettage in order to make a certain diagnosis and substituting hystero-gram as a method of guessing the

cause of the bleeding. In some clinics it is done as a routine way of studying all cases of sterility. To the author this appears to be not only unnecessary meddling but also subjecting the patient's pelvis to unnecessary trauma and irritation. Some gynecologists write of the therapeutic effect of the dye on the tubes. They cite as evidence the occurrence of a certain number of pregnancies following the injection. As in the evaluation of the Rubin's test, it is always difficult to know how many patients would have become pregnant if untreated, but it is difficult for us to visualize the delicate tubal cilia being aided in their work by means of any viscous substances. It would seem more likely to impede their function.

Our indications for the use of hysterosalpingography are few and definite:

1. In cases of habitual abortion there is often a suspicion of a septate or a double uterus. From a therapeutic standpoint it is essential to know as exactly as possible the condition of the uterine cavity or cavities. Suspicion can often be had of a septate uterus on curettage, but more certain information can be obtained by hystero-gram. Figure 329 shows the double uterus of a habitual aborter, and Figure 330 a bicornuate uterus



FIG. 331. A normal hysterosalpingogram. The dye has spilled into the peritoneal cavity. The bladder is also outlined by a cystogram.

of a woman who had had two miscarriages.

2. In cases of sterility in which the tubes have been proved by more than one Rubin's test to be closed and in which more information regarding the tubal status is desired.

It is important to gain as much information as possible on the condition of the tubes, and hysterosalpingography offers a method of gaining this information. It is essential in those cases in which a tubal plastic opera-



FIG. 332. Normal hystero-gram. Tubes are visualized.

FIG. 333. Bilateral hydrosalpin-  
ges with the dye.



tion is contemplated. Figures 331 to 334 show the results of studies concerned with tubal patency. Rarely, a bicornuate or septate uterus may be a factor in sterility; when this is suspected, hystero-gram should be done.

3. In cases of bleeding uteri which have been curetted where a small submucous fibroid is suspected but not diagnosed with

certainty. In such instances perhaps a curet-  
tage has failed to stop bleeding or on curet-  
tage an irregularity has been felt within the  
uterus, suggesting the possibility of a small  
submucous tumor. Figure 335 shows a  
hystero-gram in which submucous fibroid is  
excluded by this study. The irregular cavity  
was due to polypoid hyperplastic endo-  
metrium.



FIG. 334. Normal  
uterine cavity with  
tubes occluded at cor-  
nua.

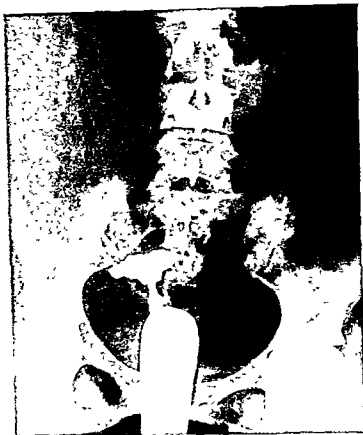


FIG. 335. Hystero-graph showing irregular uterine cavity due to polypoid endometrial hyperplasia.

### TECHNIC

The optimum time for performing hysterosalpingography is about a week after the cessation of the previous menstrual period. The patient is placed in the lithotomy position on an x-ray table that is equipped with a Bucky diaphragm. It is assumed that a previous careful bimanual pelvic examination has been made recently so that the operator is familiar with the size and the position of the uterus and the condition of the adnexa. A bivalve speculum is placed in the vagina, and the cervix is exposed. The anterior lip of the cervix is grasped with a 2-prong tenaculum, and the cervix is swabbed with cotton swabs soaked in Zephiran. The last swab is inserted about an inch into the cervical canal and is rotated. A uterine sound is inserted to determine the direction and the length of the uterine cavity. Then the cannula is introduced in the same direction, but not to the full depth of the cavity. Grasping the tenaculum and the cannula in one hand, the operator manipulates the syringe with

the other. At present we are using Salpex, which we have found to be very satisfactory for visualization. There has been no evidence that it causes irritation. About 2 cc. of the dye is injected, and the exposure is made. This film is developed and inspected. If the film indicates that the media is entering the uterine cavity, 3 or 4 cc. more is injected, and the film is developed. If inspection of that film indicates incomplete filling of the uterine cavity, more dye is injected fractionally (a few cc. at a time) until a filled cavity is visualized. The dye is injected under low pressure; in case resistance is encountered, the injection is discontinued, and a plate is taken, developed and inspected.

When visualization of the tubes is desired, more dye is usually necessary, but in most cases about 6 cc. will suffice. If more is needed it may be injected, provided that the first film shows the dye within the uterine cavity. Since the aqueous dyes are absorbed quickly, there is no object in taking a 24-hour film, as was previously often done when Lipiodol was used.

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# Sterilization

## GENERAL CONSIDERATIONS

Sterilization has properly won for itself a permanent place in surgery, although there are and always will be differences of opinion on the medical, the eugenic, the religious and the legal aspects of the subject. In the hands of responsible medical men it can be a force for great good in relieving physical and mental distress. In the hands of the unscrupulous, it has potentialities for evil that are equally great. One might question the inclusion of a chapter on the indications for sterilization in an "Operative Gynecology," but the gynecologist is generally called upon to do the job, although the indications may be neither obstetric nor gynecologic. Therefore, it is desirable that the gynecologist familiarize himself with all aspects of this subject about which much difference of opinion exists. After all, in the eyes of the law the individual who does the actual work of sterilization is apt to be held chiefly responsible for the act. In general, the gynecologist must accept the opinion of the internist or the psychiatrist as to the indications for sterilization in their particular fields. However, among psychiatrists of the best standing there is great difference of opinion on the subject, to say nothing of the ultraliberal views of some psychiatrists of doubtful ability or motives. One need only read the testimony of some psychiatrists in court to recognize that there are those with purpose none too high. A well-meaning but not too-well-informed gynecologist might easily become the scapegoat as the result of being involved with such psychiatrists.

The legal status of sterilization is not uniform throughout the United States. Thirty-one states have passed eugenic laws of some type. In general, these may be divided into two groups:

1. Those that make sterilization manda-

tory under certain conditions without the consent of the patient or those responsible for her.

2. Those that require consent of the patient and/or those responsible for her.

The validity of the Virginia law was tested in the Supreme Court of the United States, and the now-famous decision was written by Justice Oliver Wendell Holmes:

It is better for all the world if, instead of waiting to execute degenerate offspring for crime or to let them starve for their imbecility, society can prevent those who are manifestly unfit from continuing their kind. The principle that sustains compulsory vaccination is broad enough to cover cutting the fallopian tubes.

However, in 5 other instances the enacted state laws have been declared unconstitutional.

Myerson has drawn attention to the fact that even though in some states for many years laws have been passed permitting sterilization, relatively few of the patients who should or could have been sterilized under those laws have actually been sterilized. He attributes this to the fact that laws cannot be ahead of public opinion and cannot be enforced successfully if public sentiment does not favor them.

If eugenic sterilization laws are to be enforced, the public must be educated to the point of agreeing with the laws. Many doctors have side-stepped what appears to be their responsibility in such matters; this may be due either to their skepticism as to the correctness of the law or to apathy. We believe that it has been chiefly the latter, combined with a disinclination to accept responsibility for an action that has potentialities of future trouble.

Other medical men openly disagree with the existing laws, either on the basis of religion or because of their own beliefs. Un-



fortunately, many doctors without any psychiatric training or experience have strong opinions on the subject and act accordingly. Since in many states there is no law regarding sterilization, it becomes the duty of the medical profession to act in the matter according to its best judgment and to be sufficiently well informed on the subject to be entitled to an opinion.

In order to determine the manner in which the existing state laws are carried out, Gamble ascertained the number of sterilizations per 100,000 of population in 1948 in the states having such laws. The number varied from 11.5 in Delaware to less than one in several states. These figures bear out the thought of the previous paragraph that laws are carried out only in proportion to the sentiment of the public.

Ideas regarding sterilization vary greatly in different hospitals. In Catholic hospitals surgical sterilization is absolutely prohibited unless it occurs incidentally in connection with an operation done primarily for the removal of diseased organs. Other hospitals are quite liberal in their indications. In order to obtain the combined judgment of the more responsible members of the staff and to protect the doctor doing the sterilization, some hospitals have committees to act on recommendations for sterilization. In our institution, the doctor who intends to perform the sterilization must have the written recommendation of two doctors in whose field the reason for the sterilization lies. The case is then presented to the chief of the gynecologic service for his written approval.

It is regrettable that a law cannot be formulated which would be satisfactory to a great majority of the population and would cover all the medical aspects of the question. Because of the irreconcilable differences in the attitudes of the various religions and because of the multiplicity of medical conditions, about which there is much difference of opinion on the part of the medical profession, it is obvious that such a law can never be written. Hence, decisions will have to continue to be made on the merits of individual cases by physicians exercising their best judgment and conscience.

For the physician's protection it has been our practice for many years to require the signature of both husband and wife to a

letter requesting sterilization. The letter is written in simple nonmedical language so that there can be no doubt as to the ability of the signers to understand its contents.

In case of sterilization for psychiatric reasons it is well to obtain, if possible, the signature of the patient as well as the responsible member or members of her family. Many sterilizations done for psychiatric conditions are performed on under-age children. Their mental condition may prevent them from being able to sign their names. In such instances the signature of the mother and the father are required. If the subnormal child is able to sign her name, it is well to obtain her signature as well as those of her parents.

One of the more recent studies of the subject was made by Guttmacher at the Mt. Sinai Hospital in New York. The study is of particular interest because he divided the patients into private and public ward groups. It becomes quite obvious that the indications in the two groups vary considerably. On the private service there were 119 cases with the following indications:

Multiparity	26 cases
Heart disease	4 cases
Repeated cesarean sections	65 cases
Hypertensive disease	3 cases
Previous vaginal plastic operations	5 cases
Varicosities	4 cases
Eugenic reasons	2 cases
Diabetes, psychiatric disorders, poor obstetric history, asthma, previous nephrectomy, brain tumor, epilepsy, chronic back pain, 3rd degree uterine prolapse and obstructing pelvic tumor	1 case each

On the ward service there were 425 cases with the following indications:

Multiparity	340 cases
Repeated cesarean sections	51 cases
Heart disease	9 cases
Hypertensive disease	6 cases
Diabetes	6 cases
Psychiatric disorders	5 cases
Poor obstetrical history	2 cases
Varicosities, eugenic reasons, asthma, obstructive jaundice, carcinoma of the cervix and Hodgkin's disease	1 case each

Sterilization was offered for socioeconomic reasons to women at the birth of the 6th child, regardless of the mother's age. Sterilization was offered to mothers between

30 and 35 after the 5th child and after the 4th child if the mother has reached the age of 35. These views seem to me to be reasonably conservative. Sterilization is entirely voluntary on the part of the patient and her husband, and the carrying out of such a program would undoubtedly spare many mothers untold mental and some physical suffering.

In general, the indications for sterilization can be divided into three groups: (1) psychiatric, (2) medical and (3) obstetric and gynecologic.

### PSYCHIATRIC INDICATIONS

That the status of heredity in mental disease is still unsettled is evident from the report of the investigation made by the Committee of the American Neurological Association. This committee is as qualified to speak on the subject as any group of physicians in this country; yet in their report they frankly admit ignorance on several phases of the subject. It behooves every gynecologist to be informed to some degree on the subject for his own protection, if for no other reason. Accordingly, a summary of the report by Myerson is quoted here:

1. Schizophrenia has an inherited basis, although this is not the entire story, and there is very likely an environmental root or factor of some kind which at present is entirely unknown.

2. The same is true in about equal measure of manic-depressive psychoses.

3. It cannot be stated of feeble-mindedness that the bulk of it rests on a heredity basis of some type; that there is an inheritance to intelligence, although not of the "like begets like" variety, since despite the fact that there are families of feeble-minded, the bulk of feeble-minded according to reliable work comes from families which are, on the whole, representative of the total community in social standing, achievement and general intelligence. This is certainly true of the cases one sees in private practice where sporadic feeble-mindedness frequently appears among groups of the highly intelligent and where relative feeble-mindedness—in the sense that an individual, although he develops above the level of the accepted standard for feeble-minded, is, compared with the advantages and the group among whom he has lived, definitely deficient in intelligence—repre-

sents by far the greatest part of feeble-mindedness. Nevertheless, and excluding the work obviously faulty, no serious worker in the field of feeble-mindedness doubts that a great deal of mental deficiency, if not the most of it, is congenital and probably hereditary in origin.

4. Of epilepsy the report stated that there was some constitutional etiologic basis, but that it was not proved to be of hereditary origin. Recent work has tended to show that there may be more of a hereditary basis than we assumed to be the case. This depends upon the study of the brain waves and is the product of a notable Boston group of workers, Lennox, Gibbs and Gibbs. I believe that the study of brain waves has not reached the precision and reliability which these workers assume it to have, nor do I agree that the kind of brain wave they describe is limited to epilepsy, so that their studies showing abnormal brain waves in parents, collaterals and siblings of epileptics, which they assume shows the hereditary basis of epilepsy, are not so well founded as one might believe to be the case at first glance. An important paper attacking their assumptions in this matter is that of Finley and Dynes. Epilepsy, or, more precisely, the convulsive states, appears to be producible in all forms of life beyond the most primitive, can be brought about in any human being by drugs, electricity, and brain damage, and so differs radically from schizophrenia and manic-depressive psychosis. The most that can be said as to its relationship to heredity is that some individuals and familial groups are more liable to it.

5. So far as crime is concerned, this being one of the conditions which ardent eugenicists expect to be reduced by sterilization, I can only say that this Committee rejected in general the hereditary nature of most crime. There are too many social variables in crime for it to be accepted as an essentially biologic condition. It may well be that some criminals are abnormal variants. This is surely not true of all of them, and the studies which have purported to prove this have, on the whole, been too precariously based on the shape of ear lobes, height, weight and head-form to have reached a place worthy of the name of scientific at this time. There are individuals who lack social feeling, who are crass and crude egotists, who find conformity difficult, and such individuals are found at the top of the social ladder among successful as well as at its bottom and among those who are incarcerated in jails.\*

\* Myerson, Abraham: Certain medical and logical phases of eugenic sterilization, *Ann. Int. Med.* 18:587-589, 1943.

The above summary of Myerson seems to be a fair statement of knowledge and lack of knowledge of the psychiatric conditions for which sterilization is commonly done. In addition to the hereditary factor there is the factor of environment which is equally important, and in some instances more so. It is true that the physical condition of many mentally defective people tends to render them unattractive to the opposite sex; hence, the chances of their having offspring are reduced. On the other hand, one sometimes sees physically attractive women of moronic mental caliber. Some of them have a sex urge that they are unable to resist, and the request for sterilization by their parents should be heeded. When such women marry, they often are very fertile and are not capable of using properly the devices for contraception. They are also unfit to make a reasonably good home for their children. There can be no doubt that filth, poverty and general lack of parental care influence a child's way of thinking. Although some criminals come from homes with every advantage, there is little doubt that homes without proper parental influence produce many more. The limitation of such a family is a service to the individual, her offspring and to society in general.

### MEDICAL, GYNECOLOGIC AND OBSTETRIC INDICATIONS

These indications are so interwoven that it is impossible to separate them for the purpose of discussion. For example, pyelitis, diabetes, hypertension, cardiac disease and tuberculosis are joint medical and obstetric problems. Likewise, a woman who suffers from obstetric lacerations resulting from a rapid succession of children may be frail and ailing generally, and a general medical examination is necessary to evaluate the entire picture. Although the various indications in the field of medicine, obstetrics and gynecology frequently do not call individually for sterilization, there are many such indications, and in the aggregate they often necessitate sterilization. Lull has reported on 589 cases of sterilization for the following medical, obstetric and gynecologic conditions: previous cesarean sections, toxemia, cardiac disease, renal disease, pulmonary tuberculo-

sis, Para X with hemorrhage during first stage of labor, ventral hernia, secondary anemia, poliomyelitis, vaginal stricture, former dystocia of cervix with rupture of lower uterine segment, bicornuate uterus, chorea, varicose veins of vulva, previous extensive plastic operations, malignant hypertension, asthenia, lacerated pelvic floor and cervix, prolapse, pelvic tumors, Friedländer pulmonary infection, and multiple operations resulting from auto accidents. In addition, Eastman lists as indications for contraception, and at times sterilization, diabetes mellitus, hereditary deafness, hereditary blindness, congenital malformations, erythroblastosis fetalis, hereditary hemophilia, great multiparity and at times economic distress. Certain of the more important of these will be discussed below:

*Repeated toxemias of pregnancy* is one of the more frequent causes for sterilization. In a recent review of the literature of contraception Eastman pointed out that

once a patient has suffered from hypertensive toxemia of pregnancy, she stands better than a 40 per cent chance of encountering the same complication in her next gestation; after she has experienced toxemia in two successive pregnancies the chances are overwhelming that any later pregnancy will be similarly complicated; and it is almost certain that she will be left a permanent hypertensive. Moreover, after a woman has suffered from preeclampsia, or other hypertensive syndrome in pregnancy, the baby's outlook in the next pregnancy is poor.\*

Chesley, Somers, Gorenberg and McGeary found that following 466 hypertensive pregnancies 23.1 per cent of future pregnancies terminated in abortion or stillbirth. Each case of toxemia is an individual problem and, in addition to the severity of the toxemia, the number of existing children, the intensity of the couple's desire for children and other factors all should be taken into consideration before a decision for contraception or sterilization is made. Since in advanced hypertensive disease in multiparae therapeutic abortion is often indicated, abdominal hysterotomy with tubal ligation is frequently the method of choice.

\* Eastman, N. J.: The aims of birth control and their place in preventive medicine, *New Int. Clinics* 1, Ser. 5, p. 271, 1942.

*Cardiac disease* occurs in about 1 per cent of pregnant women, according to Eastman. Hamilton and Thompson quote a death rate of 5.2 per cent for the first 750 cardiac patients at the Boston Lying-In Hospital, but recently by better cardiac care the rate has been cut in half. A mortality rate of 2.5 per cent is 8 times the mortality rate for normal pregnant women. Hamilton and Thompson showed that in patients with rheumatic cardiac disease but no history of fibrillation or cardiac decompensation the risk of pregnancy was only slightly greater than that of pregnancy without cardiac disease. When auricular fibrillation or cardiac decompensation had been present, the risk of pregnancy was 3 times that of a normal woman. From this evidence Eastman believes that the only logical conclusion should be to interdict pregnancy in all women with a history of cardiac decompensation or fibrillation. Although exceptions may be made occasionally, the rule should be contraception or sterilization of husband or wife.

The effect of pregnancy on *tuberculosis* in the mother has long been a debated subject. It has now been shown quite conclusively in the experimental laboratory that pregnancy *per se* does not affect adversely the course of tuberculosis. In addition, Forschner showed that the mortality rate among 341 tuberculous pregnant women was no different from that of 396 nonpregnant tuberculous women of corresponding age. Ornstein and Kovnat showed that the percentage of women who died or did poorly at the Sea View Hospital on Staten Island, N. Y., was slightly greater in the nonpregnant group of tuberculous women than in the pregnant tuberculous women. These statistics, correct though they are, do not tell the whole story. The strain that comes with the care of a new baby interferes with rest and thus violates the first principle of the treatment of tuberculosis. If pregnancy is permitted, long hospitalization of the mother before and after delivery is necessary. She should not be allowed to care for the baby, and domestic help must be provided so that the mother can take the essential rest. In view of these facts, the family of a tuberculous woman should be limited by contracep-

tion or by sterilization of husband or wife.

The maternal mortality rate in *diabetes* is given by Eastman as in the neighborhood of 5 per cent. This is almost 3 times the mortality rate among diabetic individuals of the same age-group. There are 3 main factors in this increased mortality. The vomiting of pregnancy makes it extremely difficult to keep diabetics in regulation. Dieckmann found that the incidence of toxemia at the Chicago Lying-In Hospital among the patients in general was 7.4 per cent, whereas among diabetics it was 55 per cent. Finally, in the diabetic mother, in spite of insulin and dietary control, *huge babies* are common. Death *in utero* is common, and delivery complications are increased. In addition to the effect on the mother, Pincus and White, on reviewing the vast clinical data available at the Deaconess Hospital in Boston, concluded that diabetes is inherited as a simple mendelian recessive. Although all other investigators do not agree with Pincus and White, it seems logical on the evidence at hand to limit the families of diabetics, and in case there is diabetes in both branches of the family, to forbid childbearing entirely. Obviously, sterilization of either partner is the surest and simplest method.

*Hemophilia*, although rare, constitutes an excellent reason for sterilization. It should be remembered that hemophilia is transmitted through the hemophilic male or through the healthy female with hemophilic ancestry. It behaves as a mendelian recessive. Interpreted in practical language, this means that hemophilic men and healthy women with hemophilic ancestry should not reproduce. Because of the seriousness of this condition, sterilization rather than contraception should be used to prevent conception.

*Chronic or recurrent pyelitis* may greatly impair the general health of a woman and at times has a fatal outcome. The urinary stasis of pregnancy makes it very difficult, and in most instances impossible, to clear up the infection during pregnancy. The persistence of the infection for the duration of the pregnancy, with more and more involvement of the kidney substance and fibrosis and stricture of the ureter, reduces greatly the chances of ever clearing up the infection. When in-

fection has been present during a pregnancy but has been cleared up afterward, contraception should be practiced for a period of 2 years after sterilization of the urine. When infection persists, the question of future pregnancy in each case is a problem unto itself. When a child is of the greatest importance, a pregnancy may be permitted under some circumstances with the closest observation and with the understanding that the pregnancy may require termination. When the kidneys are seriously damaged, sterilization of one partner is often desirable.

About 10 per cent of *blindness* is thought to be hereditary. Among lesions that are considered to be hereditary are certain types of optic atrophy, congenital cataract, glaucoma and retinitis pigmentosa. Sterilization in cases of blindness should be done only on the advice of a competent ophthalmologist.

*Deafness* is estimated to be hereditary in 15 to 30 per cent, according to Eastman. A thorough examination by an otolaryngologist to determine the type of deafness is required, and sterilization should be done only when recommended by such a specialist.

Murphy has shown in an extensive statistical study made in Philadelphia that the chance of a *congenitally malformed* child is about 24 times as great in families already possessing a malformed child as in the general population. Murphy estimated that a woman with a malformed child has about 1 chance in 9 of having another. He further estimates that if, in addition, she has had one or more miscarriages her chances of having a malformed child are even greater. Under such circumstances the facts should be told to the parents, and the question of further children should be considered in the light of the number of normal children she has. In some instances sterilization and adoption would seem to be the logical solution.

*Previous cesarean sections* have become one of the most common indications for sterilization. According to Eastman, the percentage of rupture of cesarean scars is in the neighborhood of 5 per cent, and most obstetricians do not trust them. Since delivery of subsequent children is often by cesarean

section, an excellent opportunity is offered for sterilization when indicated.

*Great multiparity* has been shown by Eastman to be an important factor in increased maternal mortality. In a study of 45,145 deliveries at the Johns Hopkins Hospital he found that the maternal mortality rose sharply after the 8th pregnancy. In the lower brackets (I to VI) it ranged between 3.55 and 3.78 per 1,000 deliveries, but it soared to 11.73 per 1,000 with a parity of 9 or more. Eastman found chronic hypertensive vascular disease to be a common complication in this group and believed it to be the most common cause of death. Obesity, increased weight of the baby, increased incidence of transverse presentation, breech presentation and multiple pregnancy also appeared to be factors. Such evidence, produced by Eastman, would seem to afford ample justification for limiting the family.

*Economic distress* is probably the phase of sterilization about which there exists the greatest controversy. The author believes that, within certain limitations, it constitutes a legitimate indication. The limitations are closely related to multiparity. To deny a healthy couple the privilege of parenthood of 2 or 3 healthy children simply on the basis of poverty would be unjustifiable, but to deny a couple the privilege of limiting their family, at their request, when their economic burden is already more than they can bear comfortably is also unjustifiable. Those who live in the world of theory would offer the alternative of banishing poverty. Everyone admits the desirability of this, but those with a practical turn of mind will admit that to do this completely is quite out of the question. In spite of billions spent in the past several years by the United States Government with the avowed intention of helping the underprivileged, we have not been able to eliminate the distress of poverty. The plight of the parents is not the only consideration. Children born in poverty are often undernourished and miss the care that every child should be entitled to receive. The right to a decent rearing seems to us nearer to fundamental justice than the chance for poverty-stricken parents to have unlimited offspring. Sterilization of one or the other of the

couple is the surest solution. If for religious reasons the couple cannot take advantage of sterilization, they should be given information regarding the Oöginö-Knaus theory in relation to rhythm contraception.

### OPTIMUM TIME FOR STERILIZATION

The act of sterilization is the duty of the obstetrician and the gynecologist. For the obstetrician, the opportunity often presents itself when cesarean section is done. However, sterilization should not be used as an indication for cesarean section. Adair and Brown showed that there was a considerable increase in morbidity when sterilization was combined with cesarean section. The morbidity for all types of sterilization combined with cesarean section was 43 per cent, in contrast with a morbidity of 12 per cent for simple puerperal sterilization. It is the opinion of most obstetricians that the optimum time for sterilization is approximately 24 hours after vaginal delivery. Some have practiced sterilization within an hour after delivery, but there are two practical objections to this. The occurrence of deliveries at night makes it impractical to disturb further the night's rest of the staff by performing sterilization. Furthermore, the danger of hemorrhage still exists so soon following delivery. If sterilization is done 24 hours after delivery, the patient will have recovered from the immediate effort of labor, and the danger of hemorrhage is greatly reduced. The hospital stay is not appreciably increased by deferring sterilization for 24 hours.

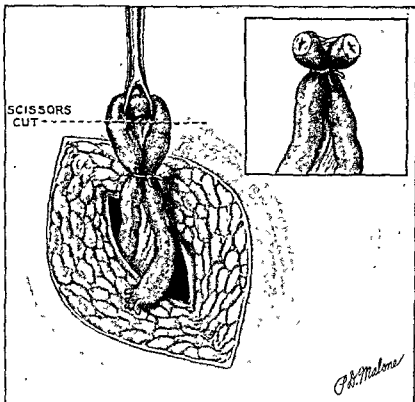
The opportunity for sterilization comes to the gynecologist often when suspensions and vaginal plastic operations are done. In fact, when an extensive vaginal plastic operation is performed, sterilization should be done at the same time if a chance of further pregnancy exists. We do not refer to a simple perineal repair, but when a radical cystocele operation is done alone, or in combination with an operation for descensus, it is often unwise to permit further pregnancies. It is mandatory to sterilize when the Watkins transposition operation is done in a woman in the childbearing age, for the safe course of pregnancy is incompatible with the introposed uterus. Vaginal hysterectomy and

the Spalding-Richardson composite operation have the advantage of automatic sterilization.

### METHODS OF STERILIZATION

Hewitt and Whitley have found on searching the literature, that there are 26 ways in which a woman may be sterilized. Although there are undoubtedly several satisfactory technics, there is no point in considering all of them. We shall describe here the technic of a few methods that we have found to be satisfactory. Sterilization may be done by the abdominal or the vaginal route. In the chapter on prolapse of the uterus we have described cornual resection used in connection with the Watkins transposition operation. The Pomeroy method of sterilization can also be done in connection with the transposition operation, the Manchester operation and simple cystocele repair. If a vaginal plastic procedure is indicated, we believe that sterilization should be done by the vaginal route rather than to perform additionally a laparotomy. On the other hand, we do not believe that the vaginal route should be chosen for sterilization when vaginal plastic surgery is not indicated. In this opinion we are at variance with Boysen and McRae who recommend it as the approach of choice in routine sterilization and report only 1 failure in 169 nonpregnant women. Their good results clearly show that sterilization can be carried out per vaginam on the nonpregnant uterus quite satisfactorily. The preference of the individual operator is a legitimate factor in making the decision as to the approach. Because of easier access and better visibility of the tubes we prefer laparotomy as the routine method. The mortality and the morbidity is practically nil for either approach. Boysen and McRae also prefer the vaginal approach for sterilization when done with therapeutic abortion. In this we differ with them, and the reader is referred to Chapter 30 on therapeutic abortion. In surveying their results in 30 cases over a 10-year period, using either cornual resection or the Pomeroy method done per vaginam, they report a failure of 16.6 per cent. This high percentage of failures alone would indicate to us that the abdominal approach is superior in the pregnant woman.

FIG. 336. Pomeroy tubal sterilization. The tube has been withdrawn through a short mid-line incision, and a knuckle has been ligated. Inset shows knuckle excised with divergent ends.



On our obstetric service the routine technic in use at the present time, when laparotomy is done for sterilization only, is that of Pomeroy. Lull also used it extensively and reported on 589 cases. In sending questionnaires to the women in his series, 390 answered, and none had become pregnant. Although the Madlener technic has been widely used, and some satisfactory results have been reported, the experience with it on our obstetric services has not been entirely satisfactory. It seems only reasonable to believe that there will be less chance of pregnancy after cutting the tube than after simple crushing and ligation. The slight additional surgery required for the Pomeroy operation is negligible. When sterilization is done in connection with cesarean section, the Irving technic is usually used on our obstetric service. It is simple of execution, and the results are sure.

The routine method of sterilization of the nonpregnant uterus by laparotomy on the gynecologic service for several years has been cornual resection of the tubes. It has proved to be very satisfactory, and the author has had no failures.

Aldridge has described a technic of burying the fimbriated ends of the tubes between the leaves of the broad ligaments. It has the advantage of permitting the ends of the tubes to be released from the broad ligaments if at a future time pregnancy would seem to be desirable. In our opinion, sterilization should rarely, if ever, be done when there is doubt about the desirability on a permanent basis. However, it is conceivable that others might disagree on this point; therefore, Aldridge's technic is described. Although we personally have never sterilized a woman by this method, it would seem to offer the best chance of reversal if unusual circumstances should make further childbearing desirable.

Finally, vaginal hysterectomy should be considered as a means of sterilization in many cases, especially when there has been grand multiparity. The operation in the hands of a competent operator can be done at no greater risk than a tubal ligation, and post-operative recovery is equally rapid and comfortable. Often these patients have relaxed outlets, rectoceles and cystourethroceles, which may be giving no or minimal symptoms, but they are worthy of correction at

the time one is performing a vaginal hysterectomy. The idea of a hysterectomy may be somewhat startling to the patient, but if time is taken to explain to her that the uterus serves no useful purpose except childbearing, usually she will agree that the riddance of future menstruation and possible uterine disease is desirable. If, on the other hand, the patient shows any doubts concerning the hysterectomy, it is a grave mistake to attempt to force the idea.

In recent years total abdominal hysterectomy at the time of the repeated cesarean section has been advocated by a few gynecologists. We cannot subscribe to the idea of superimposing a second major operation on another, either of which may be attended by substantial blood loss. Although Hallatt

and Hirsch have reported a series of 65 cases in which the two operations were done without mortality, it is my opinion that such good fortune could not continue indefinitely. The fact that the operations were of such magnitude that 47 blood transfusions were required rules the double operation out in our opinion when the end could have been accomplished by a far simpler procedure.

#### TECHNIC: POMEROY OPERATION FOR TUBAL STERILIZATION

A short mid-line incision is made at approximately the level of the fundus of the postpartum uterus. One tube is delivered with a Babcock clamp which grasps the tube at about the middle. As the loop of the tube is held up, it is crushed with an Ochsner

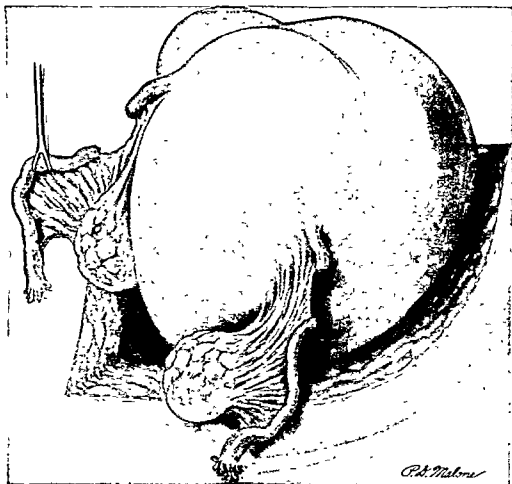


FIG. 337. End result of Pomeroy sterilization done 3 years before.



clamp and ligated with No. 0 chromic catgut (Fig. 336). The loop is then cut off with the scissors, as shown in the dotted line. At the completion of the operation the two severed ends of the tube have a tendency to diverge from one another as shown in the inset. This process is repeated on the opposite side, and the mid-line incision is closed.

It is not often that one is permitted to observe the ultimate condition of the tubes following a Pomeroy sterilization. Recently, such an opportunity was presented to us when a hysterectomy for fibroids was necessary some years following the sterilization. Figure 337 illustrates the findings. It will be

noted that the healed-over tubal ends are widely separated, making pregnancy entirely impossible.

#### TECHNIC: MODIFIED IRVING STERILIZATION

The tube is doubly ligated with No. 0 catgut about 1 inch from the uterine cornu and then severed. The sutures on the proximal end of the tube are left long (Fig 338 A). This tubal stump is then mobilized by dissecting it free from the mesosalpinx. A very small nick is made in the serosa on the posterior surface of the uterus near the cornu,

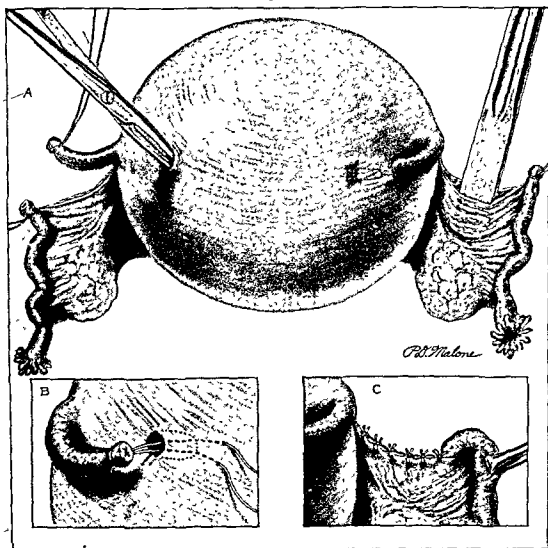


FIG. 338. Modified Irving sterilization. (A) Tubes have been cut and are being buried in musculature of posterior uterine wall. (B) Showing method of burying proximal tubal end. (C) Broad ligament is closed, and distal end of tube is buried.

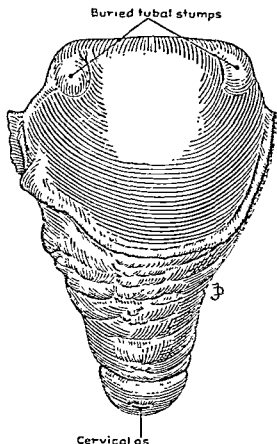


FIG. 339. Demonstrating late result of tubal sterilization by the Irving technic.

and the musculature is penetrated with a mosquito clamp for about a  $\frac{1}{2}$  inch, spreading the clamp sufficiently to admit the tube (Fig. 338 A). One of the ligatures attached to the tubal stump is threaded with a round needle. The needle is thrust to the bottom of the pocket and carried out to the uterine surface. The other suture attached to the tubal stump is treated in a similar manner, bringing it to the surface of the uterus about  $\frac{1}{2}$  inch from the first suture (Fig. 338 B). Traction is made on the sutures, and thus the tubal stump is buried in the uterine musculature. Then the sutures are tied together. A stitch of fine catgut is used to close the edges of the pocket more tightly about the tube.

According to Irving's original description of the operation, the ligated end of the distal portion of the tube is buried between the

leaves of the broad ligament (Fig. 338 C). This makes a very neat appearance but adds nothing to the effectiveness of the sterilization. Occasionally, a blood vessel may be nicked during this step, and this accident is annoying. The burying of this end of the tube is optional with the operator.

Recently, we removed a uterus several years after an Irving sterilization and had an opportunity to view the end result of the operation, Figure 339 illustrates our findings.

#### TECHNIC: CORNUAL RESECTION OF TUBES FOR STERILIZATION

A ligature of No. 0 chromic catgut is placed about the tube, approximately 1 cm. from the uterine cornu (Fig. 340-1), and the tube is cut.

The tubal stump is trimmed from the mesosalpinx up to the cornu. Usually there is no bleeding from this procedure until the utero-ovarian anastomosis is reached, and then a suture ligature of No. 0 chromic catgut is placed about these vessels. In placing this suture, a bite is taken into the uterine wall (Fig. 340-2). Then the tube is excised from the uterine cornu with a small wedge of tissue as shown by dotted line in Figure 340-2.

The wound in the uterine cornu is closed with a figure-of-eight suture of No. 0 chromic catgut. The leaves of the broad ligament are separated slightly, and the cut end of the tube is buried between them (Fig. 340-3). Finally, the round and the broad ligaments are brought over the cornu for peritonization and further protection (Fig. 340-4).

The procedure is repeated on the opposite side.

#### TECHNIC: ALDRIDGE METHOD OF TEMPORARY SURGICAL STERILIZATION

The fimbriated end of the tube is detached from the mesosalpinx for a distance of about 2 cm. This mobilization is necessary in order that the fimbriated end may be buried beneath the peritoneum of the broad ligament. The anterior leaf of the broad ligament is incised for about 1 cm. just beneath the fimbriated extremity and, using a Halsted

clamp, a pocket is made to receive the end of the tube. This pocket should be in such a position that the end of the tube, when embedded, will not be under tension (Fig. 341 A).

Two sutures of fine silk are placed in the tube about  $\frac{1}{2}$  cm. from the fimbriated end. Then each end of these guiding sutures is each threaded in turn on a curved needle; the sutures are carried into the pocket and

out through the anterior leaf of the peritoneum (Fig. 341 B).

Figure 341 C shows the fimbriated end buried between the leaves of the ligament and sutured in place.

In case the sterilization process is to be reversed, the silk sutures are cut, and the fimbriated end is lifted out of the pocket. Aldridge has reported conception following the restoration of fertility by this method.

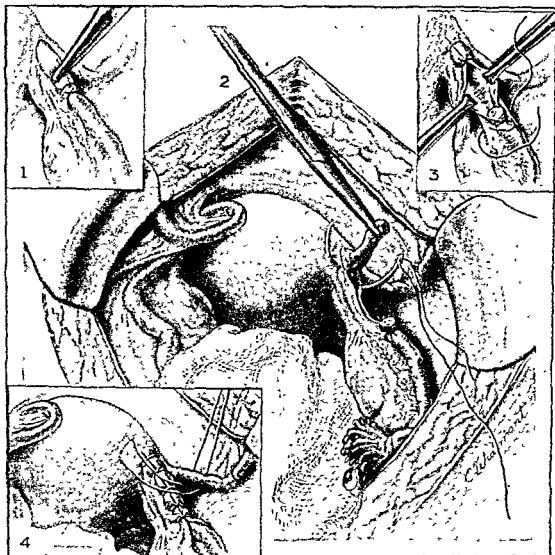


FIG. 340. Sterilization by cornual resection. (1) The tube has been ligated about 1 cm. from the cornu. The dotted line indicates the line of excision of the tube. (2) The tube has been freed from mesosalpinx. A suture is being placed about the cornual branch of the uterine vessels. (3) The tube has been excised at the cornu, and the cornual wound is closed. The broad ligament has been split, and the cut end of the tube is being buried between the leaves. (4) A mattress suture brings the round ligament over the cornual wound.

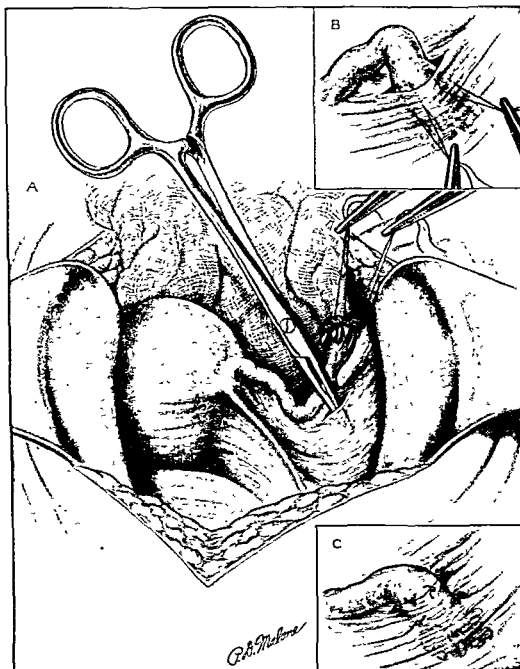


FIG. 341. Aldridge method of reversible tubal sterilization (A) The fimbriated end of the tube has been mobilized, and an incision has been made in the anterior leaf of the broad ligament. Silk sutures have been placed in the tube near the fimbriated end. (B) The method of drawing the fimbriated tubal end between the leaves of the broad ligament. (C) The tubal end has been buried and sutured in place with silk sutures.

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## Ectopic Pregnancy

In a recent thorough survey of the incidence of ectopic pregnancy in the city of Baltimore, Anderson found it to occur once to 177 total births among the white women and once to 120 total births in negroes. The incidence of ectopic pregnancy was approximately 50 per cent greater in colored than in white women. In the well-equipped hospital in which blood is promptly available the mortality today is low, as evidenced by the fact that there were no deaths in 427 ectopic pregnancies treated in 10 private hospitals in the city. The combined mortality of both races, including deaths at home proved by autopsy, was 1.6 per cent. Among the white women the mortality was 0.7 per cent; among the colored women, 3.9 per cent. These figures clearly indicate that with prompt and proper hospital care the disease is conquered, but with neglect and improper treatment it still takes its toll.

### ETIOLOGY

In order to diagnose and treat ectopic pregnancy intelligently, knowledge of the pathologic lesions which predispose to its occurrence is necessary. Mechanical obstruction in the tubal lumen plays the greatest role in the cause of tubal pregnancy, and there is little doubt that neisserian salpingitis is the most frequent cause of this. Johnson found that 22 per cent of the cases of tubal pregnancy in his series gave a history of previous pelvic infection. Gonorrhea continues to hold first place as a cause of tubal obstruction, in spite of the good results obtained with antibiotic therapy. It is possible that antibiotic therapy may even increase the incidence of subsequent tubal pregnancies, because a tubal infection, which might have been severe, is often converted into a relatively mild one by prompt treatment. The

well-developed pus tube usually becomes totally occluded, whereas the mild salpingitis often merely causes some of the folds of the tubal mucosa to become adherent, resulting in a tube with a continuous passage but with many blind pockets to serve as a cul-de-sac, into which the fertilized ovum may become trapped.

Puerperal and postabortal pelvic inflammatory disease may also bring about sufficient tubal obstruction to cause tubal pregnancy. The peritubal bands, resulting from peritonitis, may kink the tube sufficiently to prevent free passage of the fertilized ovum down the tube. In spite of the well-recognized tendency of streptococcal, puerperal and postabortive infections to extend through the lymphatics, the uterine infections also extend along the endosalpinx and, as with gonorrhea, the infected folds become agglutinated and seal off blind pockets. It is probable that even during clinically normal puerperia sufficient infection is sometimes present in the interstitial portion of the tubes to close them partially or completely. In support of this view, the author has observed microscopic pus in the lumina of the interstitial portion of tubes resected at the uterine cornua 10 days after delivery, when the puerperium was entirely afebrile.

The adhesions about the tubes and within the lumina, resulting from tuberculosis, rarely are etiologic factors in tubal pregnancy. Stevenson and Wharton found only 1 case of tubal pregnancy associated with tuberculous salpingitis among 402 cases of tuberculous salpingitis and 516 of tubal pregnancy in the Johns Hopkins gynecologic pathology laboratory. They found only 8 other similar cases in the literature, but Bland maintains that 32 such cases are recorded. In any case, the paucity of cases in the literature indi-

cates that tuberculosis of the pelvic viscera rarely is a causal factor in tubal pregnancy.

The peritubal adhesions caused by a ruptured appendix and by previous laparotomies may also predispose to tubal pregnancy.

Adhesions resulting from pelvic endometriosis may rarely be responsible for tubal pregnancy, but in endometriosis the majority of tubes are open, and it is remarkable how rarely tubal pregnancy occurs in association with this relatively common disease.

Fibroids, in certain positions, and ovarian tumors may partially obstruct tubes and be responsible for ectopic pregnancy.

It is probable that congenital tubal abnormalities, such as diverticula, may produce tubal pregnancies. There is no doubt that such diverticula do occur in noninflammatory tubes. Theoretically, they would seem to be ideal for the site of development of the fertilized ovum, but practically it is impossible to prove the presence of a diverticulum in the distorted tube that is removed at operation.

In addition to the tubal pregnancies of obstructive etiology, there are ectopic pregnancies that undoubtedly occur in tubes in which there is no suggestion of obstruction. The first pregnancy in a woman who never has had a neisserian infection may be tubal. If such a woman is operated on before rupture or tubal abortion, both tubes will appear quite normal, except for the presence of the pregnancy. There is the possibility that such implantations may be explained on the basis of ectopic endometrium occurring in the tube. In the routine examination of tubes, we occasionally encounter tubal mucosa which histologically resembles endometrium. There is the possibility that the fertilized ovum, on encountering such tissue in the tubes, may be attracted to it and develop there, even though there is no obstruction to the passage of the ovum through the entire length of the tube.

#### PATHOLOGIC PHYSIOLOGY

The pathologic physiology resulting from implantation of the fertilized ovum is of great interest, and some understanding of it is essential to intelligent diagnostic and therapeutic handling of the case. The unfortunate ovum that implants itself in the tube is handi-

capped in its development because it is on relatively poor soil. Instead of a thick protecting myometrium, it has only the thin tubal musculature. Instead of a well-developed bed of endometrium, it has only the tubal mucosa. Decidual formation in the pregnant tube is extremely variable. The decidual reaction to progesterone, although reaching its best development in the endometrium, is not entirely limited to the endometrium. For example, not infrequently a marked decidua-like change takes place in the subserosal tissues on the posterior surface of the pregnant uterus. The connective tissue cells of the pregnant tube sometimes respond to progesterone with the formation of decidua-like cells; in some cases there is no reaction whatever; in rare cases the connective tissue cells in proximity to the ovum produce typical decidual cells that compare favorably with those in the uterine endometrium. However, the mucosa of the tube never builds up into a thick decidual bed comparable with that of the pregnant uterus. The chorion burrows into the thin tubal musculature and, sooner or later, it erodes into the blood vessels. Bleeding takes place between the chorion and the tubal wall, and thus the early placenta is separated from its site of implantation. When sufficient loosening of the ovum has taken place it is cast into the tubal lumen and sometimes out through the fimbriated end.

Tubal abortion, as above described, usually takes place between the 6th and the 12th weeks of pregnancy. If the separation of the placenta has been rapid and the chorion is in good condition when it reaches the abdominal cavity, it may re-implant on the serous surface and continue to develop as an abdominal pregnancy. When the original tubal implantation is near the fimbriated end and the separation of the chorion is incomplete, the separated portion may become re-implanted in the peritoneal cavity, near the fimbriated end of the tube. The portion still attached to the tube then nourishes the embryo, while the intra-abdominal portion of the placenta is re-implanting itself. When tubal abortion takes place very early, there may be very little intratubal bleeding, and the small ovum can be completely absorbed, the whole process giving rise to very slight,

if any, symptoms. Usually, however, when tubal abortion takes place, the pain, caused by distention of the tube and by irritation of the peritoneum by blood, is very acute, and this usually brings the patient to the physician.

In a somewhat smaller percentage of cases the invading trophoblast weakens the wall of the tube to such a point that the thin wall ruptures, and blood and fetus are expelled into the peritoneal cavity. Rarely, rupture of the tube takes place between the leaves of the broad ligament, and hemorrhage forms a hematoma there. The author has seen this hematoma dissect up retroperitoneally and separate widely the two layers of the mesosigmoid.

While these changes are taking place in the tube, changes are also developing in the uterus. The endometrium undergoes a true decidual reaction. It may become a centimeter or more in thickness, depending on the duration of the pregnancy. The myometrium also hypertrophies and becomes softened. At 6 weeks the increase in size of the uterus due to these changes is usually too slight to be detected by bimanual examination. If the tubal pregnancy proceeds in development to 3 or 4 months, the increase in size and softening in consistency of the uterus is usually detectable by palpation. These changes are less than one sees in intra-uterine pregnancy of the same duration.

With the tubal abortion or rupture, the fetus dies promptly, unless the chorion quickly attaches itself within the abdomen. With fetal death there is regression of the corpus luteum of pregnancy and withdrawal of progesterone from the circulation. When this takes place, the decidua is sometimes thrown off as a complete cast of the uterine cavity, but more frequently it comes off in small particles mixed with blood. However, this is not the only source of vaginal bleeding associated with tubal pregnancy. If it were, the fetus would, of necessity, be dead in each case in which bleeding is present. This is not true, for on several occasions we have found a living fetus when there was definite vaginal bleeding. Such bleeding can only represent leakage of the blood from the tube into the uterine cavity and thence into the vagina.

## SYMPTOMS AND FINDINGS

The symptoms of tubal pregnancy are protean, depending chiefly on whether the pregnancy is intact, aborted into the tube or ruptured through the tubal wall, and on the amount of hemorrhage that has resulted.

There is nothing more difficult in gynecology than to diagnose correctly unruptured tubal pregnancy. In most instances there is a history of one or more missed periods. However, this is not invariable. Women are careless about keeping account of their menstrual dates, and even when a period is missed, the history may not relate it. Then, too, there may be spotting at about the time of the expected period, which is probably due to slight bleeding into the uterus from the tube caused by the erosion of tubal vessels by the chorion as it implants itself into the tube wall. This bleeding is always slight but may be considered to be a period by the patient. The symptoms suggesting early pregnancy are usually present, such as morning nausea and fullness of the breasts. Slight discomfort in either side of the pelvis may warn the patient that all is not well with the suspected pregnancy.

At *tubal abortion or rupture* the patient is usually taken with a sudden, severe unilateral pain. Recurrence of the pain is common, and radiation to the shoulder often follows. Fainting may occur as a result of blood loss or pain. It is obvious that the fainting is not always due to great blood loss, because we have often seen it when blood loss was slight. Pain, sudden and sharp, is the symptom that usually brings the patient for examination, but there are cases with even massive hemorrhage in which the discomfort is only slight. Vaginal bleeding usually occurs at some time after the onset of the pain. Sometimes pain and bleeding occur almost simultaneously. In such instances bleeding must be due to intratubal blood passing back into the uterine cavity. Bleeding which arises from the uterus as a result of casting off of the decidua usually begins a few days after the occurrence of acute pain due to tubal abortion or rupture with fetal death.

On *physical examination* the general condition of the patient may vary from normal



to one of extreme shock with pallor, clamminess of the skin, sweating, rapid pulse and blood pressure of shock level. A slight elevation of temperature is common, due to absorption of extravasated blood, but if the patient is seen soon after a massive intraperitoneal hemorrhage the temperature may be subnormal. On the other hand, a temperature of 104° with a cul-de-sac hematoma has caused us to suspect pelvic abscess, only to discover blood on pelvic puncture. Extravasated blood usually gives rise to a moderate leukocytosis, but there is tremendous variation in this. Normal leukocyte count is not uncommon, and on several occasions we have found the count to be over 20,000.

The findings on pelvic examination are extremely variable, depending on the duration of pregnancy and the amount of intraperitoneal hemorrhage. The cervix and the uterus often show no departure from normal when the pregnancy is at 6 to 8 weeks. Rarely is the cervix softened at that time, and the uterus shows no palpable evidence of enlargement or softening. Later, softening of the cervix and softening and enlargement of the uterus may be considerable. In early unruptured tubal pregnancy, the enlargement in the tube may be too slight for detection, and hence is often missed. When a suspicious history is coupled with a soft tubal enlargement that can be felt apart from the ovary, the chances are great that it is a tubal pregnancy. If the adnexa on the opposite side are normal to palpation, the chances of tubal pregnancy are enhanced. However, not too much emphasis should be placed on the condition of the adnexa on the opposite side. If normal, the finding is in favor of tubal pregnancy but, if adherent, it is scarcely admissible evidence against tubal pregnancy because salpingitis so frequently precedes tubal pregnancy. After tubal abortion, the enlargement of the tube is greater, and the tube becomes extremely sensitive. A tube that is distended with blood and from which blood has leaked and irritated the surrounding peritoneum is usually extremely sensitive to touch. If the tube has ruptured, it is apt to be enlarged less markedly than when tubal abortion has taken place. If the blood in the pelvis is

still liquid, the cul-de-sac may feel somewhat distended, but it is remarkable how normal the pelvic organs may feel, at times, when bathed in considerable liquid blood. When the blood has clotted, it is palpated more easily in the adnexal region or in the cul-de-sac as a soft, noncircumscribed, tender mass. Sometimes the clot may disintegrate when palpated bimanually and give the sensation of "bloody crepitus."

In spite of the most careful history and physical examination, one is often left in doubt of the diagnosis. Even though tubal pregnancy is strongly suspected, one hesitates to open the abdomen unless one is quite sure of the diagnosis. Usually one can feel relatively certain by carrying out certain diagnostic procedures that will be discussed below in some detail.

## DIAGNOSTIC PROCEDURES

### EXAMINATION UNDER ANESTHESIA

This never should be neglected even when one is quite certain of the diagnosis of tubal pregnancy. When an examination under anesthesia is done, the operating room always should be in readiness to proceed immediately with laparotomy, because pressure on the tube may aggravate bleeding. The danger from the loss of blood by pelvic manipulation is not great if the operation follows at once, and the advantages gained from the examination far outweigh the danger. Intravenous Pentothal Sodium is the ideal anesthetic for the examination; relaxation is quick and quite adequate. The patient recovers quickly from the anesthetic in case laparotomy is not done; if laparotomy is done, the Pentothal Sodium anesthesia may be combined with other agents.

Under anesthesia an early intra-uterine pregnancy may often be distinguished from an extra-uterine gestation by more careful palpation of the uterus and the adnexa. Often distinction can also be made between an ovary enlarged by a corpus luteum of pregnancy or ovarian cyst and an enlarged tube. The well-circumscribed outlines of an ovarian cyst are usually readily distinguished under anesthesia from the not-so-well-circumscribed mass formed by an enlarged tube plus the blood clot that results from tubal abortion

or rupture. Sometimes the two separate structures—the enlarged tube and the ovary—may be distinguished under anesthesia, whereas this distinction may be quite impossible in the unanesthetized patient.

#### POSTERIOR COLPOTOMY OR NEEDLING

When the diagnosis is still uncertain after examination under anesthesia, it is often desirable, while the patient is still anesthetized, to explore the cul-de-sac for blood. It has been our custom to perform a colpotomy rather than needle the cul-de-sac, and in most instances it is a more satisfactory procedure. However, if the cul-de-sac is bulging and no doubt exists about the displacement of the rectum backward, needling can be done quite safely, and it is a lesser procedure than colpotomy. In the cases without definite bulging of the cul-de-sac, colpotomy is safer than needle puncture. If rupture or tubal abortion with intraperitoneal bleeding has taken place, there is usually sufficient blood in the cul-de-sac to be become apparent the moment the colpotomy is done. Formerly, it was our practice to explore through the cul-de-sac, on occasion, when unruptured tubal pregnancy was suspected. In such cases direct visualization of the tube is necessary to be certain of the diagnosis. When the vagina is roomy, and especially when the uterus is in retroposition and the adnexa free, visualization may be easy, but in other cases it is found to be extremely difficult or even impossible. Therefore, in recent years we have restricted this procedure to cases in which rupture or tubal abortion is suspected. In those cases in which it would seem probable that inspection of the tube through the cul-de-sac might be difficult, culdoscopy is used.

#### CULDOSCOPY

We have found culdoscopy to be a most useful procedure when ectopic pregnancy is suspected from the history but when the pelvic findings are not pathognomonic. Falling into this group, particularly, are those cases of unruptured or unaborting tubal pregnancy and in those in which cul-de-sac exploration is anticipated to be inconclusive. Suspected tubal pregnancy remains our greatest indication for culdoscopy. For

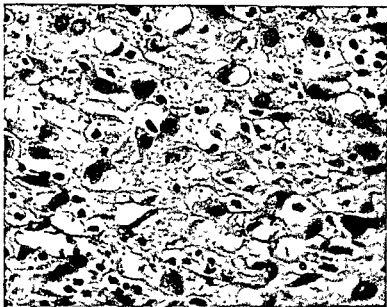
example, of 186 culdoscopic examinations done on our service during a 3-year period, 86 were done because of suspected tubal pregnancy. Fourteen of these were found to have tubal gestation. In each instance the diagnosis was found to be correct at laparotomy. During this same period of time 156 cases of tubal gestation were operated upon, indicating that we do not consider culdoscopy a routine procedure in the diagnosis of tubal pregnancy. For a full discussion of culdoscopy see pages 663 to 673.

#### PREGNANCY TESTS

When the condition of the patient is such that a delay of several hours is not dangerous, a test for pregnancy is often of value. The Friedman test performed on adult rabbits has been most generally used in this country, but the test done on the South African clawed frog (*Xenopus laevis*) is an excellent one and perhaps as exact an indicator of pregnancy. We never have encountered falsely positive tests with the frog, whereas they occasionally occur with the rabbit. It is also a more rapid test than the Friedman, and a positive result may be read in 4 hours. Never more than 12 hours is required. The test is based on the peculiar biologic function of the mature female which carries eggs throughout the year and extrudes them only after mating or injection of hormones peculiar to pregnancy. More recently the ordinary American frog (*Rana pipiens*) has been found to be an excellent animal for the pregnancy test. Three cubic centimeters of the patient's urine is injected subcutaneously into the male frog. In the presence of a positive test the male frog can be made to ejaculate sperm on touching his buttocks to a glass slide. The sperm are readily identified microscopically. We never have encountered a false positive with this test, but the test often remains negative until the 40th day of pregnancy, counting from the date of the last menstrual period. The test may be completed within 3 hours.

The results of any test for pregnancy, properly interpreted, are often of value in aiding in the diagnosis of tubal pregnancy. A positive test indicates living trophoblastic tissue, intra-uterine or extra-uterine. Hence, the test is of little value when the differen-

FIG. 342. One of many sections from endometrium showing a marked decidual reaction. The patient had had a bilateral salpingectomy and a unilateral oophorectomy. A corpus luteum cyst was present in the remaining ovary.



tial diagnosis lies between tubal pregnancy and an abortion of an intra-uterine pregnancy. In either instance the test may be positive or negative, depending on the presence or the absence of living trophoblast. When, in attempting to make an accurate differential diagnosis, it is necessary to determine the nature of an adnexal mass, the pregnancy tests are of great value. A positive test points to a tubal pregnancy, and a negative test to an inflammatory mass, an ovarian neoplasm or an old tubal pregnancy in which the trophoblast is dead and has ceased to be a factor in hormone production. It should not be overlooked that a corpus luteum cyst may be associated with a positive pregnancy test. Israel found the pregnancy test to be positive in 2 of 5 cases of corpus luteum cyst reported by him.

#### CURETTAGE

At times, a curettage may be of great value in establishing a diagnosis. If chorionic tissue is found either grossly or microscopically, the presence of a recent intra-uterine pregnancy is obvious. The presence of decidua with no trace of chorionic villi, even after careful microscopic search, is strong but not absolute evidence of tubal pregnancy. It is possible to curette a pregnant uterus and miss completely a very early ovum. Cases have been reported in which pregnancy has proceeded after a supposedly

thorough curettage, and other cases are to be found in the literature in which the curettings showed no evidence of chorionic villi, and yet the passage of a fetal sac a few days later proved the presence of an intra-uterine pregnancy. There are also rare instances in which excessive progesterone action on the endometrium calls forth a typical decidual reaction when pregnancy can be excluded with certainty. Such a case has been reported by Henricksen and Te Linde in a woman who previously had had both tubes removed, but whose remaining ovary contained a corpus luteum cyst (Fig. 342). They also reported a marked decidual reaction associated with a luteinized granulosa-cell ovarian tumor (Figs. 343, 344).

Viewing the subject from another angle, one might ask concerning the possibility of finding no decidual reaction in curettings when tubal pregnancy actually is present. In general, it may be stated that in tubal pregnancy decidua will be found in curettings unless the fetus has been dead for such a length of time that the resultant bleeding has carried away all of the decidua (Fig. 345). Siddall found decidua in 70 per cent of the cases curetted after bleeding for less than 1 week and in only 17 per cent of those cases in whom bleeding was of more than 1 month's duration. The endometrium of an unruptured tubal pregnancy invariably shows decidual reaction, unless the preg-

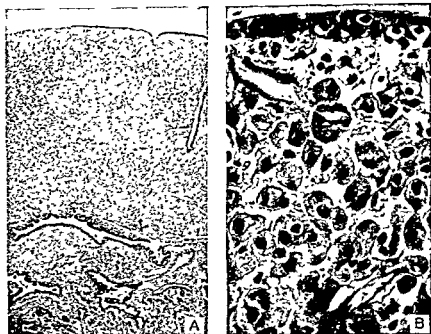


FIG. 343. (A) Low-power magnification of endometrium, showing very heavy compacta layer. Glands are sparse, and only a few show secretory change. (B) High-power magnification of section taken near the surface showing very marked decidual-like changes of the stroma cells. This postmenopausal patient had a luteinized granulosa-cell tumor.

nancy is so early that insufficient time has elapsed to permit progesterone to bring about a detectable progestational endometrial change. That such a possibility exists is shown by Figure 346, which represents the endometrium of a very early proved tubal pregnancy. The above possibilities must be borne in mind when interpreting the endometrial picture. In general, one may say that when decidua without chorionic

villi is found, there is a strong likelihood of a tubal pregnancy, but the absence of decidua does not exclude tubal pregnancy, especially if the patient has been bleeding for more than a few weeks.

Recently, Goldblatt and Schwartz have attempted to correlate the condition of the endometrium with the results of pregnancy tests. They found that in no case in which the Friedman test was negative was decidua



FIG. 344. Section of luteinized granulosa-cell tumor, found associated with decidua shown in Figure 343.

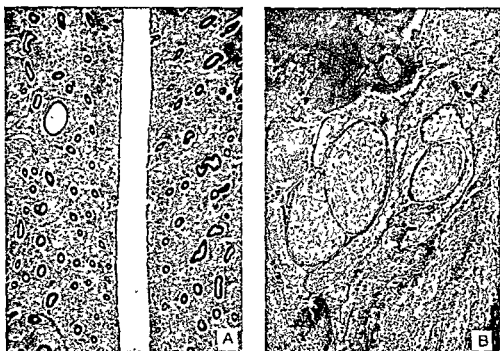


FIG. 345. (A) Endometrium of the postmenstrual type. (B) Section from the tube of the same case, showing old chorionic villi.

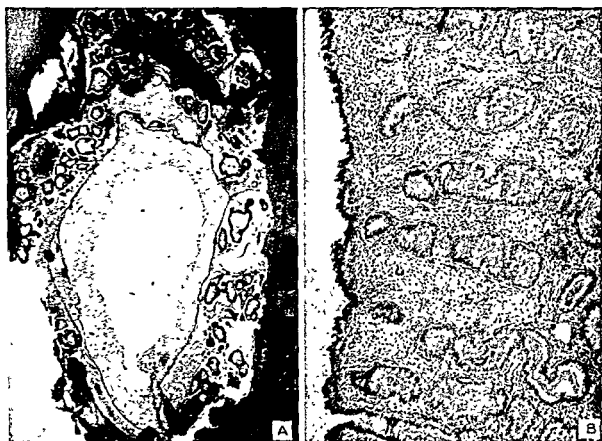


FIG. 346. (A) Early embryo found in tube. (B) Endometrium from same case, showing late interval secretory glands and absolutely no decidual change in the stroma.

found in the uterus at the time of curettage; and in no case in which uterine decidua was found was the Friedman test negative.

### SEDIMENTATION TEST

This test is considered only because it is mentioned in the literature by some authors and said to be of value as a differential test between inflammation and ectopic pregnancy. Some years ago a series of such tests was run on our service, and we concluded that the sedimentation test was of no value in differentiating these two conditions. In a recent report Johnson also concluded that the test had no differential diagnostic value.

## TREATMENT

### GENERAL CONSIDERATIONS

Today there is little room for difference of opinion concerning the desirability of prompt surgical interference in clear-cut cases of tubal pregnancy. However, there is no doubt that in the early days of pelvic surgery some women who were found in shock following rupture of the pregnancy, who were operated upon immediately, died as a result of the added shock of surgery. Hunter Robb noted this and performed experiments on dogs, the results of which he interpreted as indicating that deferment of surgery was desirable until the patient should have recovered spontaneously from the initial shock of the internal hemorrhage. Robb bases these conclusions on the fact that laboratory dogs did not bleed to death when the ovarian arteries and veins were cut without ligation. Indeed, his animals failed to die of internal hemorrhage when both ovarian and both uterine veins and arteries were cut without ligation. The cases in which death results from ruptured tubal pregnancy because proper care is deferred too long prove the fallacy of applying the results of such laboratory experiments to the human. Yet, in spite of these observations, there is still an occasional surgeon who advocates waiting for recovery from the shock without moving the patient from her home, where proper complete treatment for shock cannot be carried out. Before the days of transfusion and intravenous administration of fluids, there was the unusual case in which a policy of watchful waiting was indicated, but

today there is no justification for such a course.

In considering the operative treatment of tubal pregnancy, the cases fall into three groups. In the first, the symptoms and the signs of tubal abortion or rupture are obvious, and there are signs of shock, of variable degree, from internal hemorrhage. In this first group, immediate treatment for shock is indicated with intravenous glucose and blood plasma, while blood is being matched for transfusion. Operation should be undertaken at the first possible moment that the patient has rallied sufficiently to offer a reasonable hope of standing the operation. If, in spite of the administration of transfusion, the patient's condition seems to be growing worse, due to obvious continuation of internal hemorrhage, two transfusions may be given simultaneously. When the blood pressure has failed to such a degree that difficulty is had in performing a vena puncture, it may become necessary to cut down on a vein and insert a cannula. In this group in which there has been a rapid loss of blood intra-abdominally, there is a possibility that the fresh intra-abdominal blood will be found in good condition at operation, in which instances it should be strained through gauze into citrate solution and used immediately for transfusion of the patient. Desirable as this would appear to be, theoretically, it offers practical objections. The chief danger lies in using hemolyzed blood. The red blood cells become increasingly fragile the longer they lie in the peritoneal cavity, and spontaneous hemolysis may begin after 48 hours. It is probably unwise to use the intra-abdominal blood for transfusion if over 36 hours have elapsed between the onset of acute symptoms and the time of surgery.

In the second group, the diagnosis is reasonably certain, but there is no evidence of acute hemorrhage, and the patient is in good condition. In many of these cases rupture or tubal abortion has taken place, but the blood has clotted, and no acute surgical emergency exists. If these patients are not operated on immediately, they should be kept under close observation because frequently bleeding, after having stopped, begins again.

In the third group, the history and/or the

physical findings are quite atypical. Various diagnostic procedures are desirable and often necessary in order to establish the diagnosis with some degree of certainty before undertaking laparotomy. Into this group fall some unruptured, some old long-standing ruptured or aborted cases, as well as some recently aborted or ruptured cases in which the history and/or the physical findings deviate greatly from the typical. It is in this third group that the diagnostic procedures discussed above are of the greatest value. Usually, it is quite safe in any well-regulated hospital to await the outcome of these tests while the patient is under careful observation. On the whole, patients will fare better if this group is studied carefully than if operation is plunged into without complete investigation.

#### EXTENT OF OPERATIVE PROCEDURE

Speed is seldom of prime importance in gynecologic surgery. However, when dealing with ruptured tubal pregnancy with massive hemorrhage, it may be so important as to spell the difference between life and death. The extent of the operative procedure must be limited by the good judgment of the surgeon and is dependent upon the condition of the patient. If hemorrhage has been great, its control by the removal of the bleeding tube is all that should be done. Sometimes when tube and ovary form an adherent mass, it is easier and better to remove tube and ovary together, rather than to take time to attempt to separate the tube from the ovary. If the bleeding has been slight and the patient's condition quite satisfactory, time should be taken to inspect the opposite tube carefully and, on occasion, to remove it. In considering doing additional surgery, it is probably a good rule to err on the conservative side, rather than to do too much surgery. However, there are many cases in which removal of the opposite tube is desirable. The usual incidence given of repeated tubal pregnancy is 1 in 8. In making the decision to save or remove the opposite tube, the appearance of the tube is not the only consideration. The age of the patient, the number of her children and her desire for more children should be weighed carefully. Often the opposite tube is much better than it would appear on in-

spection. The effect of the blood on the tube often causes it to become grossly edematous and subacutely inflamed due to irritation. It should be remembered that this tubal inflammation is from without, and when it subsides, as it will when the blood is removed, the lumen of the tube is apt to be left patent. A distinction should be made between this acute chemical inflammation and the residue of old salpingitis. If the tube is obviously closed from the latter condition, it should be removed if the patient's condition permits.

Rarely, when the blood loss has been slight and the patient's condition perfectly satisfactory, a hysterectomy may be done when fibroids are present, which obviously will require eventual removal.

When the patient's condition is satisfactory, there is no objection to removal of the appendix. The argument sometimes used against appendectomy, that infection to the intra-abdominal blood might result, is not valid with today's technic. Shaw reports the removal of the appendix in 25 instances associated with tubal pregnancy, and the convalescence was not notably affected.

There is some difference of opinion regarding the disposition of the intra-abdominal blood. The author believes it should be wiped out carefully, unless the condition of the patient is so very critical that absolutely no more time should be taken before closure. The argument that the blood left in the abdomen will serve as a source of iron for the anemic patient is no longer valid, since blood can be supplied directly by transfusion much more promptly. On the other hand, blood left in the abdomen becomes organized, forms troublesome adhesions and may result in chronic abdominal discomfort. The remaining tube is much more apt to be left patent if the blood in its proximity is carefully wiped away.

#### TECHNIC: SIMPLE SALPINGECTOMY FOR TUBAL PREGNANCY

The distended tube is lifted out of the pelvis, and the mesosalpinx is clamped with a succession of Kelly clamps as close to the tube as conveniently possible (Fig. 347 A). The tube is excised with a small wedge at the uterine cornu (Fig. 347 B). The peritoneum of the mesosalpinx is usually in re-

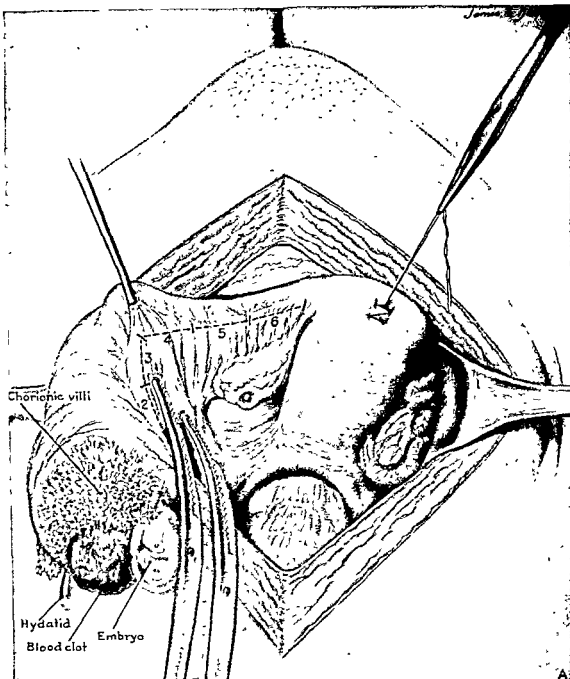


FIG 347. Salpingectomy for tubal pregnancy. (A) The tube has been delivered, and the mesosalpinx is being clamped and cut, using a succession of Kelly clamps.

latively good condition, permitting its closure and control of hemorrhage by a continuous lock stitch of No. 0 chromic catgut. This suture may be started at the uterine end, closing the incision in the uterus first and continuing laterally, or, if more con-

venient, the closure may be made from the outer end inward (Fig. 347 C<sup>1</sup>).

The two ends of the suture are then tied together, forming a loop of the mesosalpinx, which is very convenient for peritonization (Fig. 347 C<sup>2</sup>).



Peritonization is effected, and the fundus is held forward by suturing the round and the broad ligaments over the uterine cornu (Fig. 347 C<sup>1</sup>). The method of placing the peritonization suture should be noted in Figure 347 C<sup>2</sup>. The needle with No. 0 plain

catgut first penetrates the broad ligament from its anterior surface, just below the round ligaments, 1 or 2 cm. from the cornu. The next bite is taken in the fundus of the uterus a little medial to the uterine wound. This bite is taken from the anterior surface,

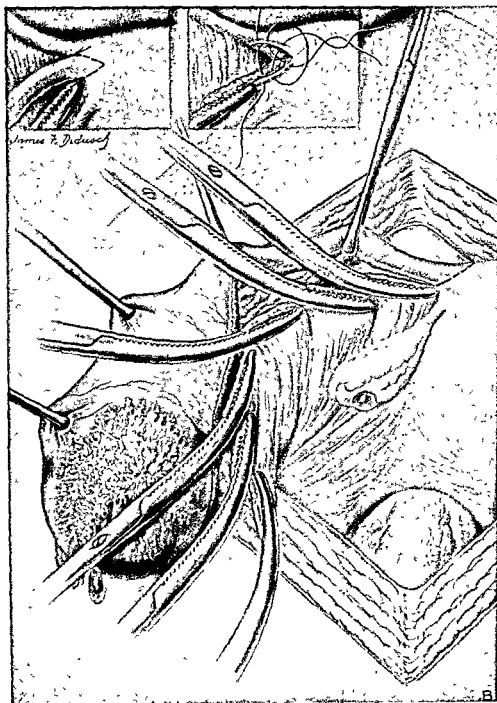


FIG. 347 (Continued). Salpingectomy for tubal pregnancy. (B) The mesosalpinx has been completely clamped and cut. The dotted line indicates the line of excision of the tube at the cornu. Inset shows suture of the excised cornu.

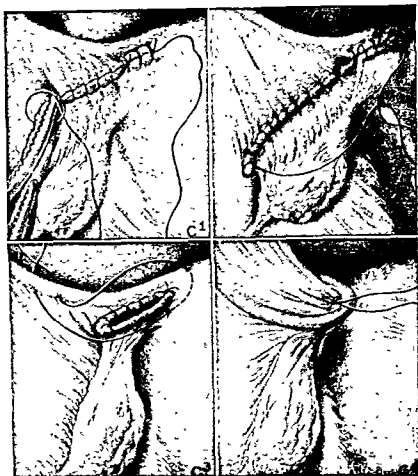


FIG. 347 (Continued). Salpingectomy for tubal pregnancy. (C<sup>1</sup>) Showing method of suturing the mesosalpinx by using a lock stitch for hemostasis. (C<sup>2</sup>) The mesosalpinx has been completely sutured. The end of the suture has been left long for tying to suture at the cornu. (C<sup>3</sup>) The mesosalpinx is thus folded back on itself so that it may be peritonized easily. The method of placing of mattress suture for peritonization is also shown. (C<sup>4</sup>) Peritonization is completed by tying mattress suture, which brings the broad and the round ligaments over the uterine cornu.

posteriorly. The suture is then placed through the broad ligament from behind, about 1 cm. lateral to the point where the suture was begun. When this suture is tied, the cornual wound and the mesosalpinx are nicely peritonized (Fig. 347 C<sup>4</sup>).

### INTERSTITIAL PREGNANCY

Interstitial pregnancy occurs in that portion of the tube that lies within the wall of the uterus. It is a rare condition, but the consequences of mismanagement are so disastrous that some space should be devoted to its consideration. Before 1893 the only available reports were from autopsies. Since then, the literature presents more than 200 cases that will stand critical analysis. Rare as the condition is, it occurs more commonly than primary ovarian or primary abdominal pregnancy.

The etiologic factors concerned in interstitial pregnancy are the same as those responsible for tubal pregnancy of the ordinary variety, the most important of which are pelvic inflammatory disease, congenital abnormalities, operative trauma and tumors. Of particular interest are those occurring in the tubal stump after salpingectomies. Richardson reported one such case and collected 7 others from the literature. The problem for speculation in such cases is whether the ovum entered the interstitial portion of the tube from the abdominal or the uterine end. Attempts have been made to classify interstitial pregnancies based on the position of the ovum in the interstitial part of the tube. The usual division is utero-interstitial, tubo-interstitial and true interstitial. Most cases are seen in a stage too far advanced to permit accurate classification, or they have rup-

tured, which makes classification still more difficult. In any event there is little practical advantage to be gained in such an artificial classification.

The gestational sac is better protected in the interstitial portion of the tube than in the remainder of the tube; as a result, such pregnancies usually are somewhat further advanced when they rupture. Eventually, the chorionic villi erode into the blood vessels at the uterine cornu, and hemorrhage results. This hemorrhage is apt to be much greater than that associated with the ordinary tubal pregnancy, since the anastomosis of the uterine and the ovarian vessels makes it one of the most vascular spots in the female pelvis. The severe hemorrhage associated with rupture usually throws the patient into serious shock with great suddenness. The abdomen becomes rigid and tender, due to irritation of the intraperitoneal blood. Frequently, before rupture the patient has some discomfort and a sense that all is not well with the pregnancy. After 2 or 3 months of amenorrhea vaginal spotting begins. Asymmetry of the uterus of a patient who has missed her period suggests the possibility of a pregnant bicornuate uterus, a pregnancy in a fibroid uterus or an interstitial pregnancy. Previous knowledge of the shape of the uterus may confirm or exclude the possibility of a bicornuate uterus. The firmness of the protrusion on the uterus suggests a fibroid. A soft, tender, asymmetric enlargement at one cornu suggests an interstitial pregnancy. Because of the fact that rupture is often deferred until the cornual enlargement is palpably enlarged, a fairly large percentage of interstitial pregnancies are diagnosed before rupture. Wynne reports that 23 per cent of the reported cases were unruptured at the time of operation. The mortality of his series was 11.9 per cent, which is at least 4 times that of ordinary tubal pregnancy. However, nearly every case operated upon before rupture survived.

#### TREATMENT

Interstitial pregnancy has been treated surgically in a variety of ways. In Wynne's series the type of operation performed was mentioned in 45 cases as follows:

OPERATION	No. OF CASES
Wound trimmed and sutured	1
Removal of fetal membranes with suture	3
Excision of pregnant sac	2
Excision of cornu	10
Supravaginal hysterectomy	26
Hysterectomy	3

It is apparent that supravaginal hysterectomy has been the operative procedure most generally used. There is no doubt that, on the whole, hysterectomy is the safest method of dealing with a cornual pregnancy. The massive intraperitoneal hemorrhage and resultant shock make the shortest operative procedure the one of choice in most cases. Supravaginal hysterectomy qualifies in this respect. However, the condition does permit a certain amount of individualization. In addition to the general condition of the patient, the condition of the tubes and the uterus, the number of children that she has had and her desire for further pregnancies should be considered before deciding on the procedure. Excision of the uterine cornu is quite feasible in a fair percentage of the cases. However, it should be done only when there is a good positive reason for saving the uterus, for in the majority of cases cornual excision is not as safe a procedure as hysterectomy. When the cornu is excised, the tube, at least, should be removed rather than reimplanted, for the reimplanted tube offers an excellent opportunity for another tubal pregnancy. Figure 348 illustrates excision of the cornu with the tube and the ovary. To save valuable time it was thought wise not to take the additional time for salpingectomy alone. It is, of course, obvious that treatment for shock is necessary in many of these cases, and usually it is more urgently needed than in the ordinary type of tubal pregnancy.

#### TECHNIC: EXCISION OF INTERSTITIAL PREGNANCY WITH SALPINGO-OOPHORECTOMY

Figure 348 A illustrates the ruptured cornual pregnancy, and the dotted line shows the line of excision.

The salpingo-oophorectomy is done in the usual manner. As the ascending uterine vessels are approached near the cornu, a suture

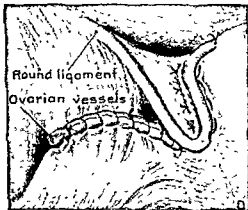
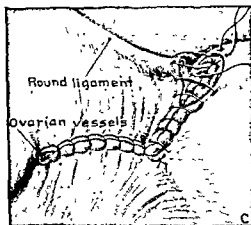
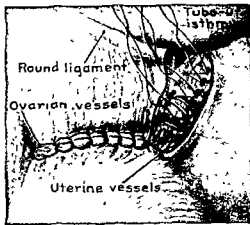
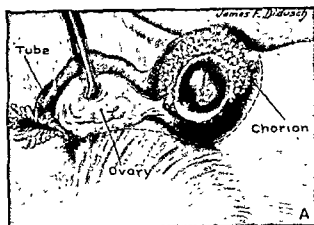


FIG. 348. Excision of cornual pregnancy with tube and ovary. (A) Dotted line denotes line of excision. (B) Tube, ovary and cornual pregnancy have been excised. Myometrium is being approximated with figure-of-eight sutures of No. 1 chromic catgut. Note that the uterine vessels have been ligated. (C) The round ligament, which was cut, is being resutured to the cornu. The ovarian vessels have been ligated, and the broad ligament has been closed with a continuous lock stitch. Serosa of the uterine wound is closed with a simple continuous stitch. (D) The cornual wound is covered over with the round and the broad ligaments.

ligature is placed about the vessels (Fig. 348 B). The cornual pregnancy is excised in a V-shaped manner, and the myometrium is approximated with figure-of-eight sutures of No. 0 chromic catgut. In doing this, it is found necessary to cut the round ligament. The round ligament is resutured to the cornu, and the uterine serosa is approximated with a continuous lock stitch (Fig.

348 C). The round and the broad ligaments are brought over the cornual wound with a few mattress sutures of No. 0 chromic catgut.

Figure 349 shows a method of excision of interstitial pregnancy in which a layer of mattress sutures is laid and tied before pregnancy is removed. After the sac is removed the superficial musculature and serosa are approximated by a second layer of sutures. This technic may save considerable blood loss.

#### ABDOMINAL PREGNANCY

The subject of abdominal pregnancy is considered separately from the other forms of ectopic pregnancy because it presents peculiar problems of diagnosis and treatment. It is a rare condition—so rare that reports of single cases are still appearing in the literature. However, more than 300 cases have been reported in the world literature. During the 25-year period between 1920 and 1944 Douglass and Kohn found

a total of 26 cases recorded in the various hospitals of the city of Baltimore, an incidence of approximately 1 case per year in a city of 1 million people. It was found once

in 4,188 live births in the Negroes and once in 67,534 live births in the white population. Thus, the condition was found to be 16 times more common in the Negro; this is

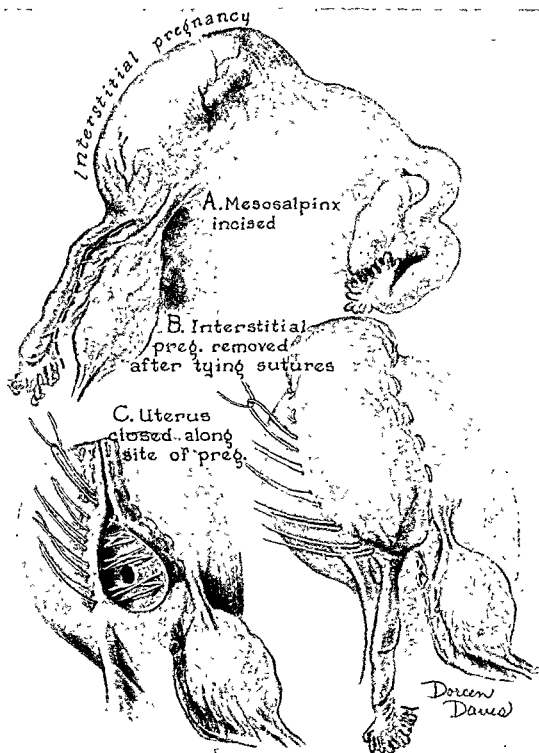


FIG. 349. Demonstrates a method of reducing hemorrhage by laying a row of mattress sutures which are tied before opening the sac for removal of pregnancy. Musculature and serosa are then closed by a more superficial line of sutures.

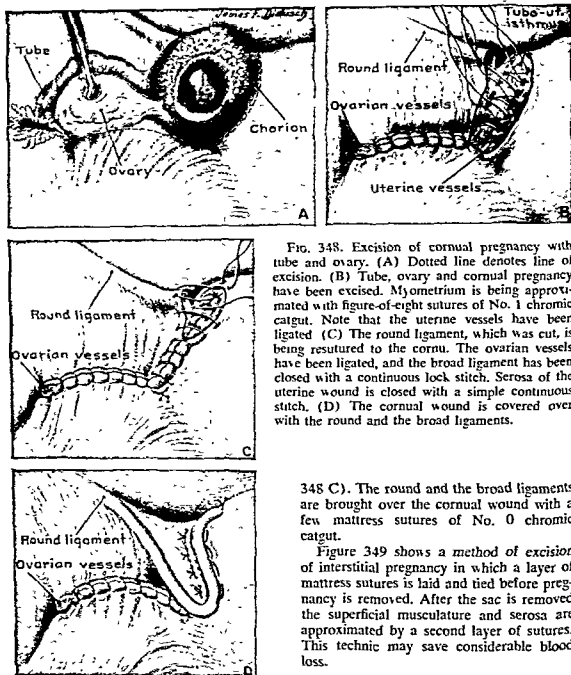


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most important diagnostic sign; the presence of these contractions rules out abdominal pregnancy. In many instances suspicion is first aroused by the patient's going into labor at term with a bloody show. After 2 or 3 days of this the fetal heart sounds will cease. Examination, under anesthesia if necessary, may reveal a cervix usually displaced upward and to one side. It is usually longer and firmer than the term cervix. Often the uterus can be felt continuous with the cervix and about the size of a grapefruit but quite distinct from the baby. If this can be done with certainty the diagnosis is made, but often it is difficult. Eastman recommends the introduction of the finger through the cervix, if it is patulous, and attempting to palpate the presenting part to determine if the fetus is intra-uterine. If the cervix is not sufficiently patulous to permit the introduction of the finger, a sound may be passed cautiously until resistance is met to judge the size of the uterus and to determine whether or not it is empty. The soft-tissue x-ray technic of demonstrating the pelvic contents is often of great help. When the diagnosis is strongly suspected, hystero-graphy may be used. Naturally, it should be avoided if the indications are that the pregnancy is probably intra-uterine. Usually with the above diagnostic procedures one can be quite certain eventually of the diagnosis.

#### TREATMENT

The majority opinion favors immediate surgery as soon as the diagnosis is made. Some have favored waiting until the fetus is dead, hoping thereby to attain thrombosis of the placental vessels. By deferring surgical intervention the chances of fetal deformity

increase, and with the advance of the pregnancy complications to the mother increase.

When the operation is undertaken one must be prepared for a possible massive hemorrhage. At least four 500-cc. flasks of blood should be in the operating room, and further matched blood should be available. Operation should not be begun until at least one needle is in a vein. One should be prepared to pump the blood in, if necessary, using a large syringe equipped with a stop-cock.

In the past there has been some discussion as to the advisability of attempting removal of the placenta. This is no longer a controversial subject. Practically everyone is agreed that the removal of the placenta should not be undertaken. The cord should be tied as close to the placenta as possible, and the abdomen should be closed without drainage. Although this is an almost invariable rule, on one occasion we found the placenta completely attached to the posterior surface of the uterus. Since further childbearing was not important, a rapid subtotal hysterectomy was done. It is rare that such an attachment makes this procedure possible or advisable. One should do as little exploring as possible lest one accidentally partially separate the placenta and cause uncontrollable hemorrhage. In most cases the residual placenta absorbs without complications or symptoms, but this is not always the case. The retained placenta may form a tender mass and require subsequent removal or may become infected and have to be drained abdominally or per vaginam. The danger of these complications is far less than that of removal or attempted removal of the placenta.

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# Culdoscopy

Since 1901, when Kelling of Dresden demonstrated inspection of the peritoneal cavity of a dog by means of the Nitze cystoscope, peritoneoscopy in one form or another has been used sporadically by a few surgeons both in Europe and in America. The work at the Johns Hopkins Hospital was developed by Shackelford of the general surgical service who stimulated our interest in it in relation to gynecology. In many instances we found peritoneoscopy to be a very useful procedure. Nevertheless, it often left something to be desired. Previous abdominal surgery, resulting in adhesions, often prevented the passage of the peritoneoscope through the peritoneal cavity into the pelvis. Also, if there was a possibility of the pelvic lesion's being of an acute inflammatory nature, peritoneoscopy was contraindicated, for there was danger of disseminating the infection through the peritoneal cavity.

The culdoscope was introduced by Decker and Cherry in 1944 and has been in use in our department since 1946. In 1957 Josey, Thompson and Te Linde reported on our experience with 594 cases and we have continued to use it regularly since. With increased experience we have come to regard it as a useful procedure and consider it a necessary part of the armamentarium of every modern gynecologic operating room.

## INSTRUMENT

The apparatus is pictured in Figure 350. There is a special trocar with a guard on the sheath about 3 cm. from the tip to prevent introducing the trocar too far. A valve is attached near the head of the sheath through which CO<sub>2</sub> gas can be introduced into the peritoneal cavity. We never have made use of this, since the results with air have been quite satisfactory. The trocar proper can be fixed in the sheath by means of a special locking device at the head of the

sheath. The culdoscope proper consists of a longer metal tube with ocular and objective lenses with a prism to deflect the light so as to make the abdominal contents visible

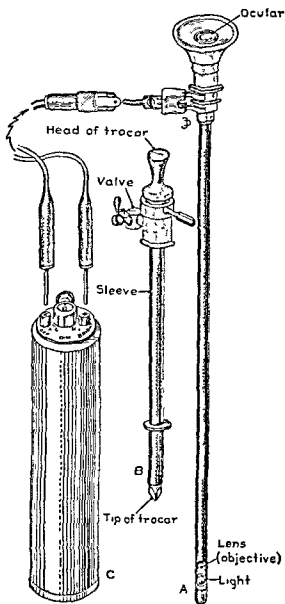


FIG. 350. (A) Culdoscope. (B) Trocar. (C) Battery.

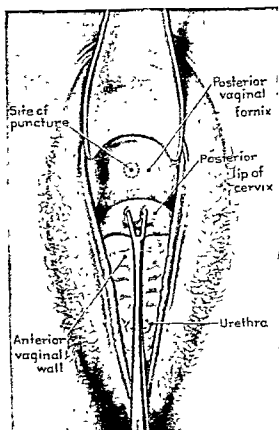


FIG. 351 View of vagina with patient in the knee-chest position, showing site of puncture.

through the ocular. Just distal to the objective lens is a small electric bulb which is illuminated by means of a dry-cell battery. The one pictured in Figure 350 is supplied by the manufacturers, but we have made a larger one which gives better illumination.

### PROCEDURE

Properly administered, any anesthesia can be used successfully, the type depending in a great measure on individual preference. In our series the anesthesia used in about 90 per cent of the cases was intravenous Pentothal Sodium, usually supplemented by nitrous oxide and oxygen. Cyclopropane, ether, caudal and spinal were used occasionally. In many clinics local anesthesia is apparently used much more frequently than in ours, and quite successfully. Pentothal Sodium has been so satisfactory in our hands that we rarely use local today. We have had no anesthetic deaths, but it should be em-

phasized that the patient should be *routinely* intubated before putting her in the knee-chest position. She is held in the knee-chest posture by two assistants, each grasping a thigh as he stands beside the patient facing the operator. Various apparatuses have been devised for holding the patient in the knee-chest posture, but if assistants are available we prefer them.

The patient is draped with an ordinary fenestrated sterile sheet. A posterior vaginal retractor is inserted into the vagina, and the posterior lip of the cervix is grasped with a tenaculum. By making gentle traction on it the posterior fornix is put on a stretch and punctured with the trochar. The fornix is punctured about an inch behind the cervix (Fig. 351). It is very thin at this point, being formed of only vaginal mucosa and peritoneum, held together by a bit of areolar tissue. The trochar thus enters the pelvis between the two uterosacral ligaments. The novice is apt to make the puncture too close to the cervix in his desire to avoid injury to the rectum. This error will result in stripping up of the peritoneum from the posterior surface of the uterus, and the cul-de-sac will not be entered. There is a flange on the sheath of the trochar which automatically prevents its introduction too far. As the trochar is withdrawn from the sheath there is an audible inrush of air. The sterile culdoscope is then inserted through the sheath (Fig. 352). Thus, the culdoscope never touches the vaginal mucous membrane, and the possibility of infection is reduced to a minimum.

The uterus, the tubes, the broad ligaments, the uterosacral ligaments, the infundibulopelvic ligaments, the rectal wall, the sigmoid, the small intestines and often the cecum and the appendix can be visualized. Figures 353 to 355 show an artist's view of several normal or nearly normal viscera. The culdoscope may be moved from side to side and rotated as necessary. The direction of vision is indicated by a marker on the eyepiece. The pelvic viscera may be moved so as to be brought into view by manipulation with the tip of the culdoscope, by movement of the cervix with the tenaculum or by having an assistant make pressure at various points in the suprapubic region. Occasionally, the lens, if introduced cold, may become foggy

due to body heat. Therefore, it is well to dip the tip of the culdoscope in warm water and then wipe dry just before inserting the culdoscope. The lens magnifies structures to some degree, depending on the distance from the object. As the tip of the culdoscope is drawn away from the object a larger field is visualized. If the object of the culdoscopy is the inspection of the tubes in connection with an investigation of sterility, a self-retaining screw-tip cervical cannula is introduced in the cervical canal. This is connected by means of a small rubber or plastic

tubing to a syringe filled with methylene blue. As the fluid is forced in, distention can be seen proximal to the point of obstruction. If the tube is patent, methylene blue solution can be seen dripping from the fimbriated end.

Figures 353 to 363 illustrate views of the various pelvic organs and diseases as seen through the culdoscope.

On completion of the examination the culdoscope is withdrawn, but the sheath is left in place as the patient is placed on her side. Pressure is made upon the abdomen to

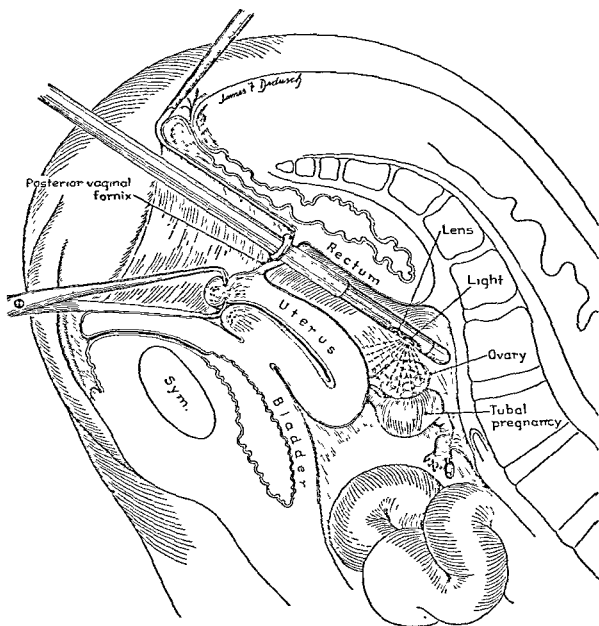


FIG. 352. Sagittal section, showing culdoscope viewing pelvic viscera.

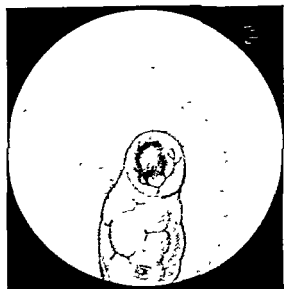


FIG. 353. Normal ovary with corpus luteum.

force the air out of the peritoneal cavity. Failure to do this adds greatly to the post-operative discomfort. The vaginal wound is not sutured, and we have had no appreciable hemorrhage from it. Figure 356 shows the wound from within the abdomen 2 days after culdoscopy.

## INDICATIONS

The culdoscope was used in our series of 210 cases for the following reasons:\*

TABLE 9

	NO. OF CASES
1. To rule out or establish the diagnosis of ectopic pregnancy	356
2. To rule out or establish the diagnosis of endometriosis	51
3. As part of endocrinologic investigation	43
4. To search for a cause of unexplained abdominal or pelvic pain	45
5. As part of the investigation for sterility	37
6. To determine the nature of pelvic masses	31
7. Suspected pelvic tuberculosis	21
8. Miscellaneous	10
<b>Total</b>	<b>594</b>

The reasons for using the culdoscope in our series of patients are listed in the above table.

\* Josey, W. E., Thompson, J. D., and Te Linde, R. W.: *South. M. J.* 50:713, 1957.

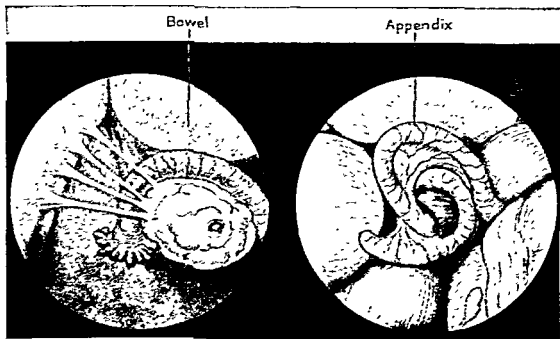


FIG. 354. (Left) Ovary with a few adhesions. (Right) Appendix.

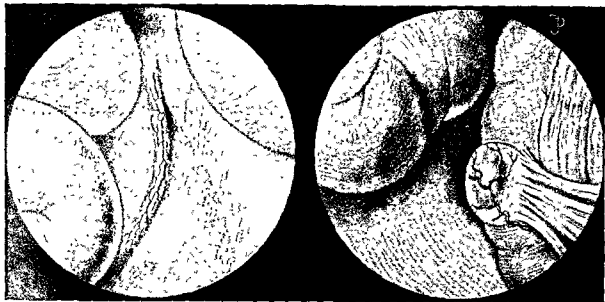


FIG. 355. (Left) View of ureter occasionally seen. (Right) Small bowel and sigmoid with serosal bleb and adhesions.

It was possible to place all but 10 of the cases in one of 7 major categories. These 10 patients, representing only 1.8 per cent of the total, had culdoscopy for such rare indications as congenital absence of the uterus, prococious puberty, postmenopausal bleeding and dysmenorrhea. Since there is some overlapping of the indications, it was necessary to assign arbitrarily certain cases to the category that, from a careful study of the records, appeared to be the predominating one. For example, several patients who were sterile were suspected of having endometriosis, as were some of those in the group classified as having "unexplained abdominal pain."

**Ectopic Pregnancy.** The most frequent indication for culdoscopy was that of ruling out or establishing the presence of ectopic pregnancy. This was the reason for the procedure in 356, or well over half of our cases. An impression of ectopic pregnancy of culdoscopy led to laparotomy in 81 patients. The diagnosis was confirmed in 57 of these. The discrepancy between the large number of suspects and the relatively few verified cases is explained by the great many negro women in our outpatient department who eventually are proven to have pelvic inflammatory disease, but in whom the clinical picture closely mimics that of ectopic pregnancy.

The 24 cases in which the diagnosis was not confirmed at operation constitute the false posi-

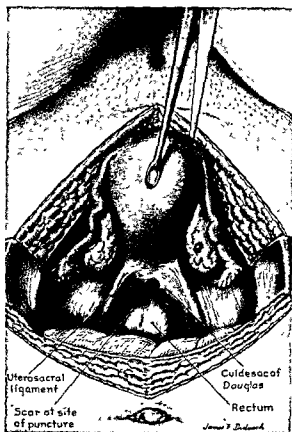


FIG. 356. View of culdoscopy wound 2 days after culdoscopy.

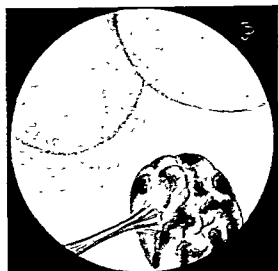


FIG. 357. Small blood clots adherent to an ovary. The dark area above is a large blood clot which is out of focus at the moment. Seen with ruptured tubal pregnancy.



FIG. 358. Blood clot seen on fundus of the uterus in case of ruptured tubal pregnancy.

tives and represent approximately 7 per cent of the culdoscopic operations done for suspected ectopic pregnancy. In exactly half of the falsely positive group the diagnosis at laprotomy was corpus luteum hematoma, of which 8 had ruptured, resulting in hemoperitoneum. Surgical intervention must be regarded as justifiable in the cases in which there was significant bleeding from a corpus luteum hematoma. Furthermore, since surgery is not infrequently indicated to relieve pain caused by a corpus luteum hematoma, it cannot be said that these patients had unnecessary operations.

With the culdoscope it is sometimes impossible to distinguish between the bluish, cystic mass of a corpus luteum or follicle hematoma and that of a tubal pregnancy. However, one is often able to make this differentiation by using the culdoscope, in which case surgical intervention may be averted. This is revealed by our study which shows that a culdoscopic diagnosis of corpus luteum or follicle hematoma was made 13 times in the total series, but in only 3 of these patients was the hemorrhage sufficient to necessitate operation.

If those who were found to have corpus luteum hematomas are disregarded, there remain 12 patients who were operated upon either unnecessarily or with questionable justification. They include 6 cases of pelvic inflammatory disease, 2 of intra-uterine pregnancy,

1 patient with the finding of a cystic ovary and 1 with small myomata uteri. Only 2 patients had perfectly normal pelvic organs.

There were two false negative examinations for ectopic pregnancy. In one of these there was a divergence of opinion between two observers regarding the culdoscopic findings.

Occasionally, one encounters serious pelvic disease other than ectopic pregnancy when culdoscopy is done to rule out or establish that diagnosis. Eight patients were operated upon for other conditions revealed preoperatively by the culdoscope, such as dermoid cyst, ruptured pyosalpinx and, of course, ruptured corpus luteum hematoma.

It should not be inferred that culdoscopy is the usual method of establishing the diagnosis of ectopic pregnancy in our clinic. On the contrary, during the period of study a total of 415 ectopic pregnancies were treated on the gynecologic service and in only 13.7 per cent was the diagnosis made using the culdoscope. If a patient presents herself with the clinical manifestations of hemorrhagic shock and the history and pelvic findings point toward the presence of a ruptured ectopic pregnancy, immediate laparotomy is indicated. Furthermore, in less dramatic cases the diagnosis can often be made with reasonable certainty by other means. Frequently, however, the findings may

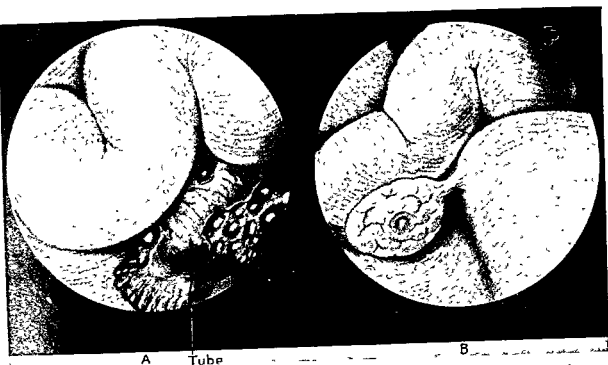


FIG. 359. (A) View of tubal abortion. (B) View of the opposite side on which previous salpingectomy had been done for tubal pregnancy.

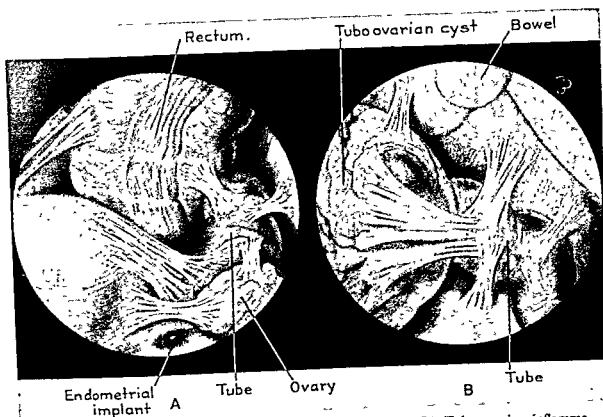


FIG. 360. (A) Endometrial implant and adnexal adhesions. (B) Tubo-ovarian inflammatory cyst and adnexal adhesions.

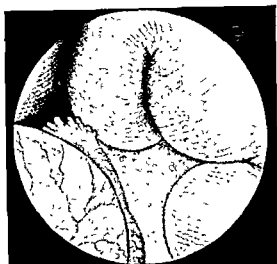


FIG. 361. Culdoscopic view of portion of an ovarian cyst and tube.

be quite suggestive but the usual methods of examination fail to settle the question. Some of these patients will eventually be found to have an ectopic pregnancy, and for this reason they must be carefully observed if expectant management is elected. In such cases culdoscopy is of great value, for if ectopic pregnancy can be ruled out the patient may be spared the expense of prolonged hospitalization, and both she and the surgeon relieved of the anxiety engendered by uncertainty.

On the positive side we believe that culdoscopy can be relied upon to pick up many early cases prior to rupture or tubal abortion. If there is little or no blood in the pelvis, culdocentesis is without value. The same is true of colpotomy unless the incision is large enough and pelvic conditions are suitable to permit tubal visualization. Of the 57 ectopic pregnancies diagnosed by culdoscopy, the fallopian tube was found to be completely intact in 15 cases. In many of the others only a few small clots were present, so that puncture of the culde-sac probably would have failed to produce blood.

**Endometriosis.** Suspected endometriosis was the indication for culdoscopy in 51 patients. The lesions were demonstrated in 10, and in 3 patients the diagnosis was later confirmed by laparotomy. Endometriosis was diagnosed 14 times when culdoscopy was done for other reasons. It is our opinion that many pelvis are explored unnecessarily for suspected endometriosis, simply on the basis of a history of severe dysmenorrhea. Without palpable evidence of this disease such explorations fre-

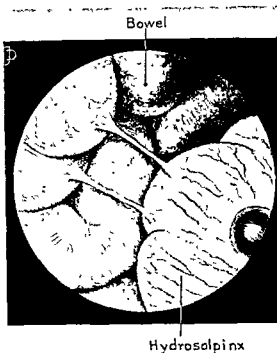


FIG. 362. Hydrosalpinx which was differentiated from ovarian cyst by culdoscopy.

quently result in negative findings. Culdoscopy will often prevent such unnecessary surgery.

On the other hand, endometrial blebs and scarring can at times be seen with the culdoscope even though the pelvis is normal to palpation. Nevertheless, failure to identify the lesions culdoscopically does not entirely rule out the presence of endometriosis. Often one is unable to visualize all surfaces of the ovaries. Similarly, one is rarely able to see the vesico-uterine fold and although the uterosacral ligaments may be seen, their attachments to the uterus are very difficult to visualize.

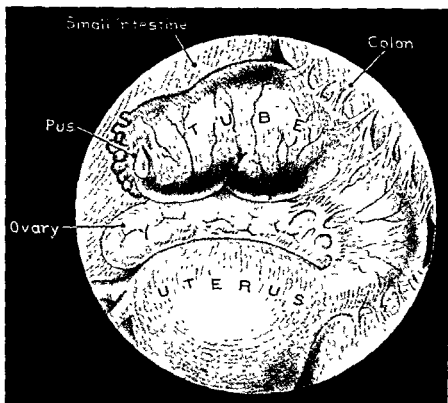
A number of patients in this group were found to have pelvic inflammatory disease rather than endometriosis. This differentiation is easily made with the culdoscope and the exact diagnosis thus made is valuable in planning further therapy.

**Endocrine Investigation.** Forty-three patients had culdoscopy as part of an investigation for the cause of endocrine disorders. The majority of them were amenorrheic, but 3 had abnormal uterine bleeding. Eleven patients with unexplained amenorrhea had positive findings, including hypoplasia of the ovaries and ovarian agenesis.

Whenever there is a question of ovarian dis-



FIG. 363. Pus tube as viewed through the culdoscope.



ease that cannot be established by pelvic examination, we regard culdoscopy as a very useful procedure. At least portions of the ovaries can usually be visualized even when the tubes are obscured by adhesions or loops of bowel.

The appearance of the ovaries in patients with the Stein-Leventhal syndrome is quite characteristic. Culdoscopies were done in 16 patients suspected of having this syndrome; in 7 of these the diagnosis confirmed by visualizing the typical large, pale, multicystic ovarian surfaces.

*Unexplained Abdominal Pain.* The search for a cause of obscure abdominal or pelvic pain can be time consuming, expensive for the patient, and frequently unrewarding for the physician. Many of these patients undoubtedly have pain on a psychosomatic basis. Occasionally, however, a cause has been found at culdoscopy and later corrected. If on the other hand no disease can be demonstrated, one may then more confidently assure the patient that no organic lesion is present or refer her for psychiatric evaluation if this seems indicated.

In this group of 45 patients, about one third had pathologic findings which might have accounted for their symptoms. Five of them were subsequently operated upon for the lesions demonstrated.

*Sterility.* The use of the culdoscope as an adjunct to the investigation of infertility is perhaps the most controversial. Its diagnostic and prognostic value undoubtedly depends on the experience of the operator. Unfortunately, its value in selecting patients for tubal plastic or other corrective operations is to some degree nullified by the notoriously poor results in this type of surgery. On the other hand, if the tubes are patent and no abnormalities can be visualized, one may then assure the patient that there is nothing that can be done surgically to aid conception.

*Possible etiologic factors* that have been demonstrated in our cases of sterility include pelvic adhesions, endometriosis, pelvic inflammatory disease, tubal occlusion as shown by injection of methylene blue, ovarian cysts, and absence of evidence of corpus luteum formation.

*Pelvic Masses.* When there was uncertainty as to the nature of a pelvic mass, culdoscopy revealed the correct diagnosis in a remarkably high percentage of our cases. Four of the 31 culdoscopies in this group were regarded as unsatisfactory. In every one of the others it was possible to visualize the mass in question. The most frequent findings were pedunculated myomata, hydrosalpinges and simple ovarian cysts. Dermoid cyst was diagnosed twice and confirmed by laparotomy in each instance. In

two other patients the diagnosis of ovarian endometriosis was made.

**Pelvic Tuberculosis.** The culdoscope was used 21 times to look for evidence of pelvic tuberculosis. Definite tuberculous lesions were discovered in two patients. In one of these the pelvic organs appeared normal but a number of tubercles were seen on a loop of small bowel. In the other patient the pelvic peritoneum was seen to be studded with tubercles. It is noteworthy that both curettage and culture of ascitic fluid had failed to establish the diagnosis. This case clearly demonstrates that culdoscopy can be a valuable aid in the diagnosis of pelvic tuberculosis.

### FAILURES

The examination was regarded as unsatisfactory in 45 cases, or in 7.6 per cent of patients so studied. In view of the inexperience of the operator in many of our cases, this would appear to be a relatively low failure rate. Inability to enter the peritoneal cavity accounted for 15 failures. This is occasionally true because the puncture is made too close to the cervix and the peritoneum is merely stripped off the pos-

terior surface of the uterus. In this event it is sometimes feasible to open into the peritoneal cavity with a Kelly clamp and insert the telescope directly into the cul-de-sac.

It is not always possible to visualize completely the adnexa following successful passage of the culdoscope. In many patients, however, it is not essential that both tubes and ovaries be seen in order to arrive at a diagnosis. For this reason we have followed the policy of designating an examination as "unsatisfactory" only if no useful diagnostic information was gained. In such cases the commonest reasons for failure were dense pelvic adhesions, fixed masses in the cul-de-sac, and inability to visualize the adnexa in question due to their fixation in an anterior position or to adherent loops of bowel.

### COMPLICATIONS AND MORBIDITY

Usually there is no appreciable bleeding from the site of puncture following culdoscopy. In only 8 cases was it deemed necessary to suture the posterior vaginal fornix. Extraperitoneal perforation of the rectum occurred three times; no untoward results ensued. Two patients are known to have developed retroperitoneal em-



FIG. 364. (A, left) Retroperitoneal air, resulting from the trocar's failing to enter the peritoneal cavity. (B, right) Air under diaphragm, resulting from failure to press on abdomen to evacuate air following culdoscopy.

physema due to entry of the trocar into the areolar tissue behind the cervix (Fig. 364 A). The air was spontaneously absorbed in a few days. In one instance it was necessary to readmit a patient for drainage of an infected hematoma in the cul-de-sac. Another patient complained of a severe backache following culdoscopy under spinal anesthesia. It was felt by the orthopedic consultant that the cause was back strain due to the prolonged maintenance of the knee-chest position. Postoperative abdominal and shoulder pain are occasionally troublesome, but nearly always are due to a failure to express all the air possible from the abdomen at the conclusion of the procedure.

A few patients have been allowed to return home within 6 to 8 hours after culdoscopy. In general, however, they are kept in the hospital for 1 to 2 days. Most instances of significant postoperative fever have been due to a flare-up of pelvic inflammatory disease. Only 15 patients who had a culdoscopy, but were not subjected to laparotomy, developed fever above 100.8°. Because of the prevalence of pelvic inflammatory disease on our ward service, antibiotics have been administered liberally. We do not consider this necessary in the majority of cases.

### OUTCOME OF CONCURRENT INTRA-UTERINE PREGNANCY

Early intra-uterine pregnancy was found at the time of culdoscopy in 45 patients. In a few others an incomplete abortion was completed concomitantly by curettage. Follow-up studies were available on 28 pregnant patients. Of these, 23 delivered uneventfully. Four of the 5 women who subsequently aborted had uterine bleeding and cramplike pain on admission to

the hospital, suggesting that abortion was threatening prior to culdoscopy.

### EVALUATION OF CULDOSCOPY AND CONTRAINDICATIONS

Although we are convinced that many patients have been spared a laparotomy by the use of culdoscopy, to support this belief objectively we felt it would be necessary to have a comparable series of patients in whom culdoscopy was not done. A strictly comparable series must be made up of cases in which the same diagnostic problems present themselves. Such a series is to be found in the group of patients who were culdoscopic failures, since they may be regarded as not having had culdoscopy at all. There were 45 patients in this group, and in 42.2 per cent laparotomy was done; whereas only 21.1 per cent of the larger group who had successful culdoscopic examinations were subjected to laparotomy. These data add statistical support to our clinical impression that culdoscopy, if used successfully, will substantially reduce the number of patients requiring laparotomy.

Although the most significant contribution of culdoscopy is that of enabling the gynecologist to avoid unnecessary pelvic surgery, the experience of our clinic upholds the broader viewpoint that culdoscopy is a valuable adjunct to the more usual diagnostic methods. It is a relatively safe procedure in the hands of experienced culdoscopists and closely supervised trainees.

The chief contraindications are the presence of a fixed mass or dense adhesions in the cul-de-sac, and inability of the patient to assume the knee-chest position due to debilitation, arthritis, cardiac disease and the like.

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# Ovarian Tumors

## GENERAL CONSIDERATIONS

The presence of an ovarian neoplasm is an indication for laparotomy, whether or not the tumor gives rise to symptoms. The justification for this statement is the incidence of malignancy in ovarian neoplasms, which is in the neighborhood of 15 per cent. This is too high to justify a policy of waiting. The problem of ovarian neoplasms may be compared with the problem of lumps in the breast. Ovarian tumors must be regarded as potentially malignant, even though pelvic examination gives no hint of malignancy. Even at operation, with the tumor under direct inspection and palpation, one occasionally has difficulty in determining whether the tumor is benign or malignant. Clinical experience coupled with pathologic studies has demonstrated that an ovarian tumor may be benign for years and finally become malignant. Consider, as an example, the large ovarian tumor that has been responsible for noticeable abdominal enlargement for years. Suddenly there is a rapid increase in the size of the abdomen. The tumor is removed. On pathologic examination much of it is found to be typical benign cystadenoma, but other parts show signs of unmistakable carcinoma. A case such as this demonstrates that the history suggesting long duration by means rules out present malignancy when dealing with ovarian tumors.

Because of the malignant potentialities of ovarian tumors, and because they are so often asymptomatic until the hopeless state, routine pelvic checkups at intervals of a year should be made. The possibility of ovarian neoplasm represents the second most important reason for annual examinations, the first being the more common malignancy of the cervix. In some women with familial his-

stories of cancer, examinations at 6-month intervals are desirable. Apropos of prophylaxis, the question arises as to the desirability of castration in pelvic surgery. This is discussed in some detail in the chapter on myomata, since it is usually in connection with hysterectomy for benign uterine disease that this question arises. Randall's statistics are of importance in considering this. He estimates that at the age of 40 a woman has approximately a 1 per cent chance of developing ovarian cancer during the remainder of her life. After that age the chance diminishes so that at 50 the chance is reduced to 0.8 per cent.

Aside from the possibility of malignancy, other potentialities indicate operation, complicate the operation and increase the operative risk. The commonest of these are torsion of the pedicle, infection and rupture.

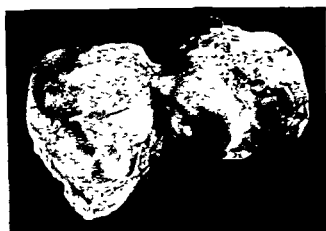
Torsion of the pedicle of an ovarian tumor is accompanied by sudden, severe pain. This may be the first symptom noted by the patient and the reason for her visit to the physician. The history of repeated episodes of pain before the final severe attack which leads to surgery suggests that patients may suffer partial twisting and spontaneous untwisting. If the torsion is not released spontaneously, the venous circulation is first interfered with, and then the arterial blood supply is cut off. The tumor becomes purple and subsequently almost black in color (Plate 4). Thromboses of the vessels of the pedicle occur, and gangrene results. A little exudate comes forth from the tumor, and the adjacent peritoneum becomes inflamed; fine fibrinous adhesions form rapidly between the tumor and the neighboring structures. The peritoneal irritation gives rise to abdominal muscle spasm;

PLATE 4



Ovarian cyst twisted with tube on pedicle.

PLATE 5



(Top) Follicular retention cyst. (Bottom) Cystic ovary. The enlargement is due to multiple follicular retention cysts.

PLATE 6



*(Top)* Granulosa-cell tumor of ovary.  
*(Bottom)* Parovarian cyst.



FIG. 365. Large follicular retention cyst.

if the content is pure blood, the cyst is more properly classified as a follicular hematoma. Multiple small follicular cysts may cause considerable ovarian enlargement of a semi-solid nature (Plate 5). Such ovaries are usually symptomless, and operation for their removal is not justified. When such a condition is encountered at the operating table in the course of a hysterectomy it is usually advisable to leave the ovaries in, especially in young individuals. If only one ovary is cystic and the other ovary normal, removal of the cystic ovary may be indicated. Needling such small cysts is practiced by some gynecologists. The procedure is harmless, but it is doubtful whether any permanent benefit results from it. Multiple follicular cysts in adherent ovaries after salpingectomy may be painful and require removal (Plate 5).

Large single follicular cysts may give rise to discomfort and even pain (Fig. 365). If one can be reasonably certain that one is dealing with this follicular type of cyst, which frequently disappears spontaneously, a period of observation is wise. Often part of the wall of the cyst is of paper thinness, and rupture at examination occasionally takes place. In the event of such an accident, the patient should be watched for possible hemorrhage, but this is rare. The patient usually becomes comfortable after a few days of abdominal

soreness. The ruptured cyst may or may not re-form. Hemorrhage into a functioning follicle may cause rupture, and the evacuation of a small amount of blood into the peritoneal cavity results in pain, slight fever and usually leukocytosis. Or, in rare instances, profuse hemorrhage may take place from this rupture. The symptoms are often confused with those of acute appendicitis or tubal pregnancy, but the differentiation is important, since surgery is seldom necessary for the slight hemorrhage from a follicle. The accident of follicular hemorrhage occurs most frequently at the time of ovulation, although it is by no means confined to that time.

Follicular cysts are commonly encountered incidentally at the operating table, when it is often quite possible to shell them out with the conservation of a good quantity of normal ovarian tissue. When most of the ovarian tissue is markedly thinned by the pressure of the cyst, oophorectomy is generally to be preferred to resection, if the patient's other ovary is normal. When the opposite ovary is absent, one may go to extremes to save a bit of ovarian tissue, and the younger the woman the greater the effort should be at ovarian conservation. The closure of the ovarian defect and control of bleeding is best made with fine catgut, used as a lock stitch with a delicate needle (Fig. 366).



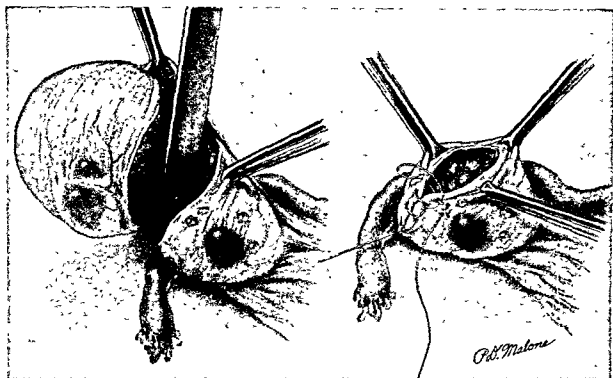


FIG. 366. Resection of a small cyst from an ovary. (Left) An incision has been made around the ovary near the junction of the cyst wall and normal ovarian tissue. The knife handle is a convenient instrument for shelling out the cyst. (Right) The wound in the ovary is closed with a continuous lock stitch of No. 00 chromic catgut on an atraumatic needle.

**Corpus luteum cysts** are formed from corpora lutea. Instead of retrogressing normally they remain cystic, with an excess of fluid content. The lutein cells persist in a variable degree of preservation, and a wall of fibroblasts is deposited on the inner surface of the lutein zone. In the older cysts the lutein cells almost completely disappear, and the fibrous zone is heavy, whereas in the more recent cysts there is a zone of healthy-looking lutein cells with only a little fibrous tissue within (Fig. 367). There is often a yellow cast to the thinner portion of the cyst wall. A distinction should be made between the normally functioning cystic corpus luteum and the corpus luteum cyst that is the product of abnormal regression. The normally functioning corpus luteum contains a small amount of straw-colored or blood-tinged fluid. Occasionally, this is excessive, forming a cyst, and yet the function of the corpus luteum is undisturbed. Such a cystic, functioning corpus luteum seldom attains a diameter of over 3 cm. The corpus luteum cyst

may be equally small or even smaller, although sometimes it attains a diameter of 5 to 6 cm. and in rare instances an even greater diameter.

The normally functioning corpus luteum may become of surgical importance because of excessive bleeding into it. The hemorrhage may cause rupture and create a clinical picture simulating appendicitis or tubal pregnancy. This accident may occur at any time following ovulation; we have seen it during menstruation and even during early pregnancy. As in the case of the follicle, the bleeding is usually slight, and surgery is not necessary. Occasionally, surgery is required because of excessive bleeding, but more often the abdomen is opened because of symptoms suggesting acute appendicitis or tubal pregnancy. The cystic lutein wall in most instances can be shelled out and the ovary saved.

The true corpus luteum cyst is commonly associated with a disturbance of or delay in menstruation, but the variation is not uni-

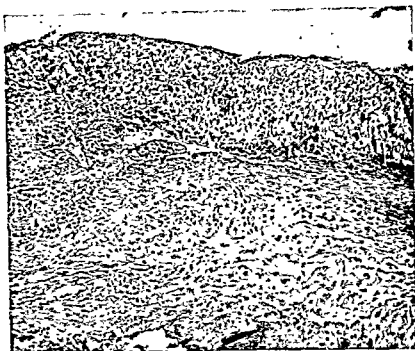


FIG. 367. Wall of a corpus luteum retention cyst. Lutein tissue is shown on the upper surface of the photograph.

form. When the menstrual period is delayed, with discomfort in the lower abdomen, a differentiation must be made from tubal pregnancy. A period of watchful waiting for spontaneous disappearance of the cyst is usually justifiable. A peritoneoscopic examination of the abdominal cavity is frequently of value. If the cyst and the discomfort of sufficient severity persist, surgery is indicated. A decision at the operating table between enucleation of the cyst and oophorectomy is contingent upon the condition of the rest of the ovary, the condition of the opposite ovary and the age of the patient.

Corpus luteum cysts are not to be confused with multiple lutein cysts of the ovary occurring with hydatidiform mole and chorioepithelioma.

**Germinal inclusion cysts** are frequent microscopic findings on histologic examination of ovaries. They never attain sufficient size to give rise to symptoms or to be recognized at the operating table. They are of no clinical significance.

**Endometrial cysts** are in a sense retention cysts and therefore are noted here, but they are discussed under the general heading of endometriosis.

## NEOPLASTIC CYSTS OF THE OVARY

**Pseudomucinous cystadenomas** may attain an enormous size and average much larger than the serous variety (Fig. 368). They derive their name from their thick, viscid, pseudomucinous contents. This may be as thin as egg albumin, but in some instances it is gelatinous and too thick to flow. As in all cystic tumors, hemorrhage may occur in them, changing the usually almost colorless fluid to chocolate color. These tumors are multilocular or parvilocular and are composed of large, rounded cystic compartments. The walls of the tumors are of variable thickness; the thicker portions are bluish white, while the thinner portions are darker; when there is intracystic hemorrhage they may be very dark. The thicker areas in the wall may contain innumerable small locules which constantly increase in size and thus the tumor grows (Fig. 369). As this process is going on within the cyst, the walls of the larger compartments become thinned by pressure, and often there is rupture of one locule into another. Papillary excrescences on the outer surface of these tumors are rare, and within the cysts excrescences are much

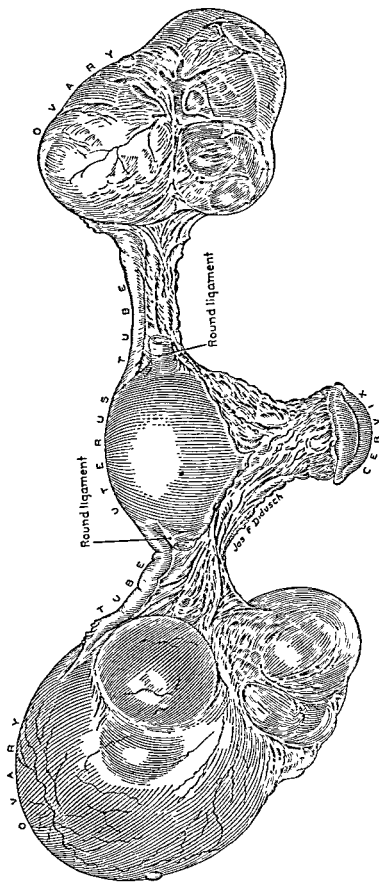


FIG. 368. Bilateral pseudomucinous cystadenomas of the ovary.



FIG. 369. Wall of a benign pseudomucinous cystadenoma.



FIG. 370. Papillary pseudomucinous cystadenoma.

less common than in serous cystadenomas. However, they do occur as shown microscopically in Figure 370. The tumors are commonly bilateral, so that when a unilateral tumor is encountered the opposite ovary should be inspected carefully to make certain

that it does not contain a very small cyst. Pseudomucinous cysts become secondarily malignant in a small percentage of cases (5%, Meyer). Those cysts with papillary ingrowths or outgrowths are much more apt to become carcinomatous than cysts without

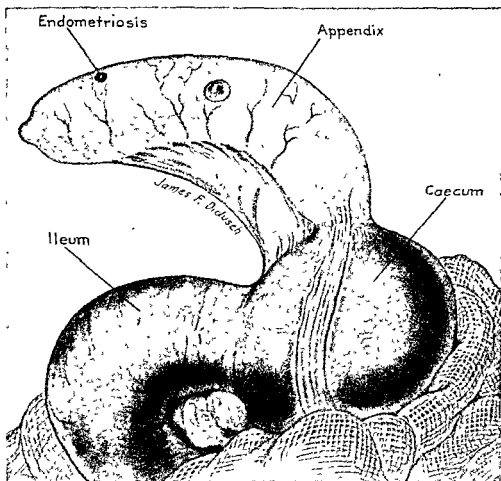


FIG. 371. Mucocoele of the appendix.

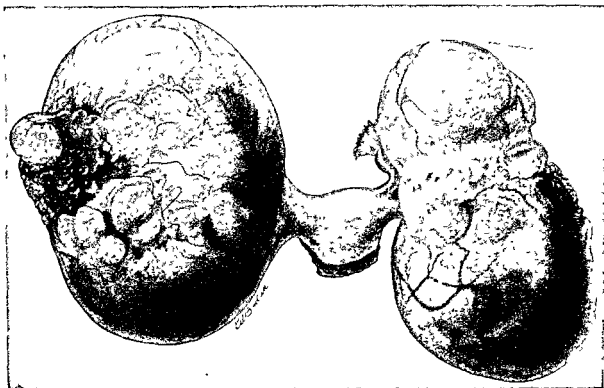


FIG. 372. Serous papillary cystadenomas of the ovaries.

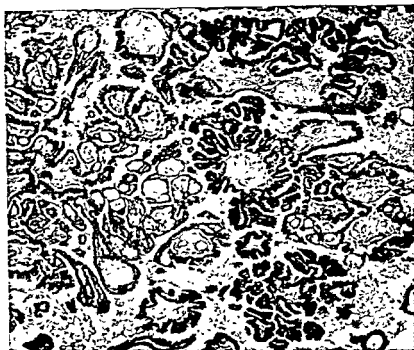


FIG. 373. Section of papillomata from serous cystadenoma.

papillary growths. The history of long-standing abdominal enlargement and the finding of areas of malignancy in an otherwise benign cystadenoma indicate that cystadenomas may persist for years as benign tumors and then become malignant. When pseudomucinous cystadenomas are encountered in young individuals unilateral adnexal removal is indicated, unless there is a suggestion of malignant change. After the age of 40, bilateral oophorectomy is usually advisable because of the tendency to bilaterality.

Occasionally, a *mucocoele of the appendix* is found associated with these cysts (Fig. 371). Pseudomyxoma peritonei may result from rupture of pseudomucinous cysts or appendiceal mucocoeles due to the transplantation of secreting cells of the tumor onto the peritoneum. Although this condition is not truly malignant, it is impossible to remove completely all the myxomatous material at operation; its reaccumulation is sure to follow eventually, and this finally will be responsible for the patient's death.

Serous cystadenomas are a little less frequent than the pseudomucinous variety (Fig. 372). They, too, may become enormous, but their average size is less than that of the pseudomucinous cysts. They are named

from the serous fluid that they contain, which is usually straw colored; if there is hemorrhage, the fluid may be altered to the color of chocolate or coffee. These cysts are multilocular or parvilocular and appear to be composed of a conglomeration of round cystic masses, or they may give the appearance of being single large cysts which on section may have a few large compartments and many small ones in the thicker portions of its wall. Papillary excrescences are common on the exterior of the cyst wall but are even more common on the interior. They are shown grossly in Figure 372 and microscopically in Figure 373. These papillary growths frequently implant upon the serous surfaces of the abdominal viscera and may or may not produce ascites. Grossly, these implants suggest malignancy, even when histologically they are surprisingly benign. After removal of the parent tumor the histologically benign implants, even though widespread, may regress. When implants are present, a hysterectomy and a double salpingo-oophorectomy should be done, even though the other ovary appears to be normal. When the papillary serous cystadenoma is unilateral and entirely free, and no implants are found on other viscera, one should still consider

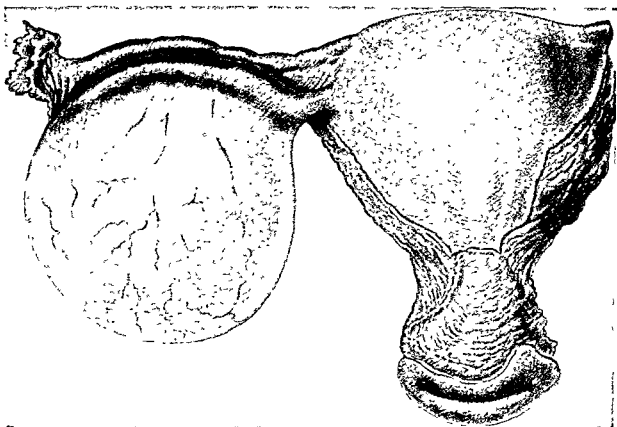


Fig. 374. Unilocular serous cystoma.

doing a radical operation, especially in women in their late thirties and beyond. The justification for this lies in the tendency of these tumors to become bilateral ultimately and to change to malignancy. The incidence of secondary malignant change in serous cystadenomas greatly exceeds that of the pseudomucinous variety. The temptation to insert a trocar into these serous cysts generally should be resisted; the incision should be enlarged to permit removal intact. With enormous cysts, evacuation by trocar may be unavoidable. However, before inserting the trocar the exterior of the cyst should be inspected carefully for papillary excrescences, and their presence should weigh heavily against puncture. When evacuation by trocar cannot be avoided, the area to be punctured should be protected carefully by gauze; on withdrawal, the opening in the cyst should be clamped shut quickly to avoid spilling of the contents.

**Simple Serous Cystomas:** Closely related to the serous cystadenomas is a unilocular

cyst filled with thin fluid which is clear unless stained from intracystic hemorrhage (Fig. 374). Histologically, the low epithelial lining is similar to that of the serous cystadenomas, but the walls of the cyst are not formed of adenomatous tissue. They are almost always smooth-walled externally, but rarely have papillary excrescences seen on the surface. When small they must be distinguished from retention cysts, but their wall is usually thicker. They are quite benign and almost uniformly unilocular; unilateral ovarian removal is all that is necessary for cure, but when they occur after the menopause, a hysterectomy and a double salpingectomy should be done, if the patient's condition warrants it.

**Dermoid cysts** are among the commoner ovarian tumors, but they occur less frequently than the cystadenomas. Figure 375 shows the gross appearance of a cyst that has been opened, and Figure 376 shows a typical microscopic section of the wall. They range from microscopic size to very large tumors.

We have seen a dermoid cyst weighing 50 pounds, but usually they are not larger than a child's head. They are closely related to teratomas of the ovary but differ from them in three important respects. They are cystic; their tissues are chiefly ectodermal in origin; and the incidence of malignancy is low. Their rather thick walls are usually bluish white in color and very smooth; the thickness of the wall and the sebaceous contents give them a somewhat solid feeling, and they are heavy for their size. If the operator is uncertain of the nature of the cyst, it can be

identified easily by its sebaceous and hairy contents when it is opened after removal.

About one fourth of the dermoid cysts are bilateral. Because of this tendency to bilaterality, these cysts often require radical pelvic surgery. They may come to light clinically in a patient of any age, but their occurrence in young women, and even in children, is not uncommon. When they appear at a very early age and are bilateral, they constitute one of the tragedies of gynecologic surgery. When the opposite ovary appears to be normal, it should be inspected

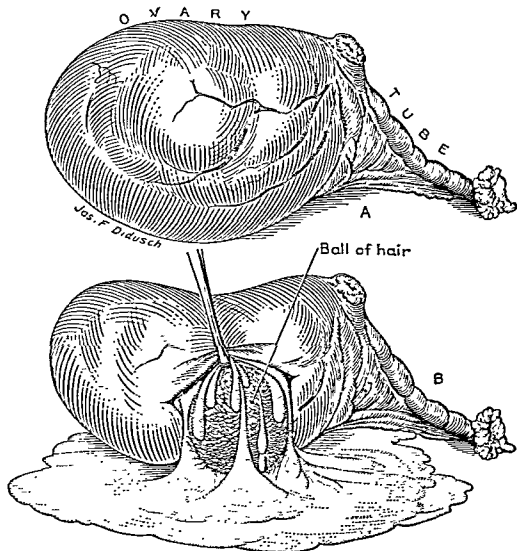
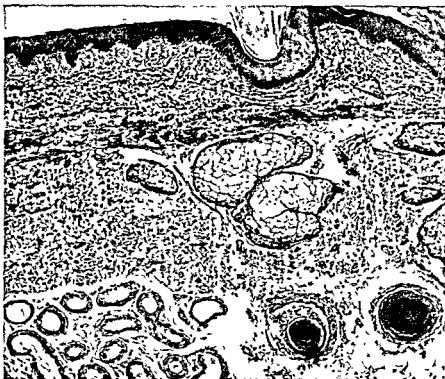


FIG. 375. (A) Dermoid cyst of ovary. (B) Cyst has been opened, and sebaceous contents and a ball of hair are pouring forth.



FIG. 376. Wall of a dermoid cyst, showing stratified squamous epithelial surface, sebaceous glands, sweat glands and hair follicles.



carefully for a very small dermoid. A small suspicious cyst may be needed; if the content is oily, the diagnosis of dermoid can be made. In young women such a cyst may then be resected, if possible, leaving the patient sufficient ovarian tissue to preserve the menstrual function.

**Struma Ovarii.** Thyroid tissue is not infrequently found in small amounts in ovarian teratomas. Pick, in 1902, first recognized the true nature of these tumors. Rarely, the thyroid tissue appears to outgrow all other elements, and such tumors may properly be called "struma ovarii." Not only is the histologic picture of thyroid tissue unmistakable, but its true nature can be demonstrated by the chemical determination of its iodine content. Radioactive iodine has also been demonstrated in thyroid tissue in the ovary. The ovarian struma is usually not overactive. However, cases have been reported in which overactivity of the ovarian thyroid gave rise to symptoms of hyperthyroidism. Most of these tumors are benign, but several instances have been reported of metastasis and death. However, removal of metastatic thyroid nodules identical histologically with the original tumor has in some instances resulted in cure. The relation of the ovarian

thyroid tissue to that of the neck is interesting. Neumann reported a case in which the struma in the neck, together with the toxic symptoms, disappeared after removal of the ovarian tumor. On the other hand, Woodruff *et al.*, reported a case in which the thyroid in the neck enlarged a year after the removal of the ovarian struma.

#### BENIGN SOLID TUMORS OF THE OVARY

**Fibromas** of the ovary of sufficient size to give rise to clinical symptoms are rather uncommon. Small fibromas on the surface of the ovary occur quite frequently; and in dealing with them when they are discovered accidentally at operation they must be considered as possible forerunners of the larger tumors. Also there is a condition which for want of a better name we have called "fibrosis ovarii," shown in Figure 377 and in low-power magnification in Figure 378. As can be seen in Figure 377, the ovaries are perhaps twice normal in size. The surface is markedly convoluted, and the ovaries are extremely firm. The firmness is due to great thickening of the capsule shown in Figure 378. The relation of this condition to fully developed fibromas is unknown, but the

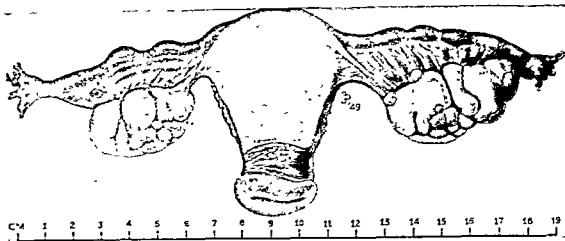


FIG. 377. Fibrosis ovarii.

finding of such a condition on pelvic examination requires laparotomy to determine the nature of the enlargement. We have seen the condition occur unilaterally, but it is generally bilateral. True fibromas feel very solid and heavy; they are smooth walled and usually more or less spherical (Fig. 379). Because of their weight, twisting is common.

Ascites is much more common with ovarian fibroids than with pedunculated uterine fibroids. Occasionally, abdominal ascites is accompanied by hydrothorax, giving rise to the symptom complex known as Meigs's syndrome, which is discussed later in this chapter. Fibromas are benign and usually unilateral. They are cured by simple oophorectomy, but when they occur in postmenopausal women—as they frequently do—there

is no advantage in saving the opposite ovary. If the opposite ovary is to be left in, it should be inspected carefully for small, surface papillary fibromas.

The Brenner tumor is the only other solid benign tumor worthy of mention; it is a rare type with gross characteristics that cannot be distinguished from the ordinary fibroma (Fig. 380). Microscopically, it appears like a simple fibroma through which are distributed islands of epidermoidlike cells (Fig. 381). The position of these deep-lying epithelial nests suggests malignancy, but under high-power magnification they do not appear malignant. Clinically, Brenner tumors are, in fact, benign and are cured by simple oophorectomy. Since they appear grossly like fibromas, most of them are removed under

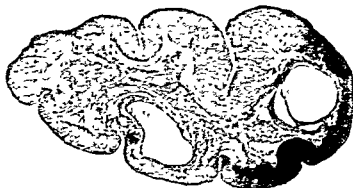


FIG. 378. Low-power view of a section of an entire ovary. The ovary was about twice normal size and was enveloped in the extremely thick fibrous capsule seen in this photograph.

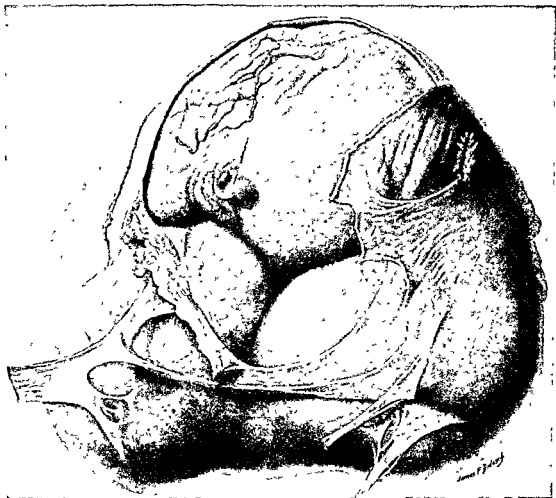


FIG. 379. Fibromyoma of ovary.

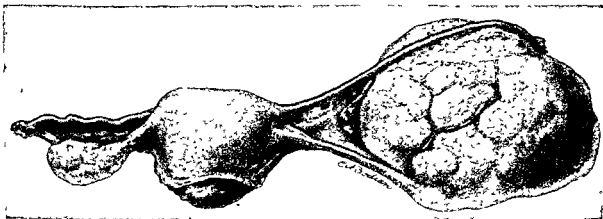


FIG. 380. Brenner tumor of ovary.



FIG. 381. Section of Brenner tumor. The islands of benign epithelium distinguish it from the ordinary fibroma.

the assumption that they are such. When, on microscopic examination, epithelial elements are found deep in the fibrous growth, there is no cause for alarm, because a follow-up of patients from whom Brenner tumors have been removed by conservative surgery indicates that they are benign.

#### MEIGS'S SYNDROME

In 1937 Meigs and Cass reported 7 cases of fibroma of the ovary associated with ascites and hydrothorax. The condition is rare but important, because it points out the fact that it is possible for a solid ovarian tumor to be responsible for ascites and hydrothorax and yet be perfectly benign. Such a symptom complex therefore calls for abdominal exploration, even though the chances are in favor of advanced malignancy. The syndrome has been defined as limited to (1) cases with fibroma, thecoma, granulosa cell tumors and Brenner tumors; (2) ascites; (3) hydrothorax; (4) and cure after removal of the tumor. All of these tumors have one common characteristic—fibrous tissue in greater or lesser degree. Pure fibromas associated with fluid in the chest and the abdomen far outnumber the other types of

tumors. It is true that some malignant ovarian tumors have been reported associated with ascites and clear straw-colored fluid in the chest. These should not be included in the true Meigs's syndrome, even though the cytologic examination of the chest fluid fails to reveal malignant tumor cells. The finding of undoubted malignant cells automatically rules out this syndrome.

The *modus operandi* of both the abdominal and the chest fluid is not clear. There is no evidence of inflammation of the serosa; pressure on lymphatics or veins does not seem likely because the fluid keeps forming even though the tumor is floating free in the ascitic fluid. Twisting of the pedicle does not seem to be the explanation, because no evidence of twisting is found at operation, and some of the tumors are large and wedged in the pelvis where twisting would be impossible. It has been suggested that these tumors by their very nature excrete fluid through their own lymphatics. Of course, this is not a real explanation but simply a hypothesis grasped at because all other explanations seem to have been excluded. The entrance of the fluid into the chest seems to be either through the diaphragmatic lym-

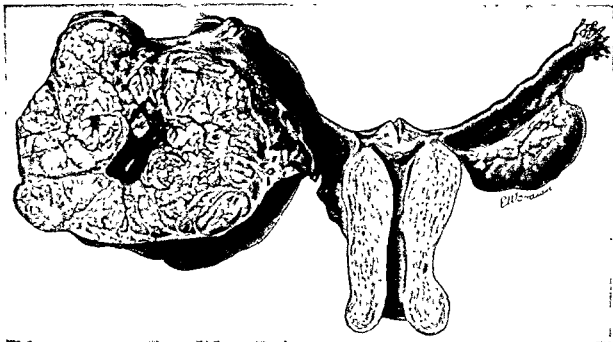


FIG. 382. Solid ovarian carcinoma. Although rather large, the tumor is still encapsulated.

phatics or small opening in the diaphragm. The direction of flow of the fluid is from abdomen to chest as has been proved by the introduction of India ink into the abdomen, and later recovering it in the chest fluid. Ink introduced into the chest fluid will not go into the abdomen.

Since the tumors are benign, simple salpingo-oophorectomy cures the patient. The ascites and the pleural effusion promptly disappears and does not recur. If the patient is near or past the menopause, the uterus and the opposite adnexa should be removed. If the tumor is thought to be granulosa, one is confronted with the possibility of some degree of malignancy. A frozen section should be made after removing the unilateral ovary and tube. If it proves to be granulosa, the opposite adnexa and the uterus should be removed.

#### PRIMARY SOLID CARCINOMA OF THE OVARY

Primary solid ovarian cancers present a host of microscopic patterns; classifications based upon microscopic structure are not uniform and are extremely confusing. In this work on operative gynecology we are not

concerned with the details of histopathology, but with the gross characteristics of ovarian carcinomata so that they may be recognized at the operating table and treated properly. Figure 382 shows a solid ovarian cancer. Figure 383 is one of the many microscopic pictures of solid ovarian cancer. The fact that an ovarian tumor is solid should immediately cause the operator to suspect malignancy. The two notable exceptions to this rule are fibromas and Brenner tumors. The surface of solid ovarian carcinomata may be perfectly smooth; more often, however, they are irregular and nodular due to outgrowths of the carcinoma through the original capsule. When in doubt as to the malignant nature of a tumor, at times the decision can be made by a careful inspection of the pelvic structures for secondary growths. The omentum is a favorite place for metastases, and this fact makes Pemberton's routine removal of the omentum in all cases of ovarian carcinoma seem to be logical. Doubtful solid ovarian tumors should be opened in the operating room by an assistant. Although the cut surface in smaller tumors is frequently quite firm, by the time the carcinomata attain even moderate size,



FIG. 383. Microscopic picture of solid ovarian carcinoma.

section usually discloses crumbling friable areas.

From the onset, solid ovarian carcinomata are often bilateral, and in advanced cases bilaterality is almost the rule. Removal of both ovaries and the uterus should be the established procedure in all solid ovarian carcinomas regardless of age, even though the opposite ovary appears to be entirely normal. We have found well-established microscopic carcinoma in the interior of the normal-appearing opposite ovary removed at operation, when the carcinoma seemed grossly to be unilateral. When feasible a total hysterectomy is to be preferred to subtotal.

#### PRIMARY CYSTIC CARCINOMA OF THE OVARY

Many cystic carcinomas of the ovary result from malignant changes in pre-existing cystadenomas. As mentioned above, the incidence of malignant change in the serous cystadenomas is much greater than in the pseudomucinous variety. From these pathologic facts it is obvious that all cystadenomas should be considered as potentially malignant, especially those with papillomatous growths. Even though these tumors appear to be entirely benign, they should be opened

in the operating room by an assistant and inspected carefully for grossly malignant areas. If the nature of the tumor is in doubt and one is considering conservative surgery, frozen sections may be made.

In addition to these carcinomata arising secondarily, there are tumors of the cystadenomatous architecture that seem to be carcinomatous from the start, all epithelial elements being unquestionably malignant (Figs. 384 and 385). In fact, the commonest malignancy of the ovary is the cystadenocarcinoma. In some cases the tumor is almost a solid papillomatous growth with very little cystic portion. In others the cystic portion of the tumor predominates. The malignant papillomata are more friable than those of the benign cystadenomas and have a greater tendency to disseminate over the peritoneal surface. Unfortunately, they often grow painlessly, and the patient does not seek relief until abdominal enlargement is apparent. Clinically and histologically, there seems to be every gradation of malignancy in these papillomatous tumors. On a few occasions we have observed extensive papillary implantation over the peritoneum, with extensive ascites secondary to papillary tumors of the ovaries, when the whole picture was

FIG. 384. Wall of cystadenocarcinoma of ovary.

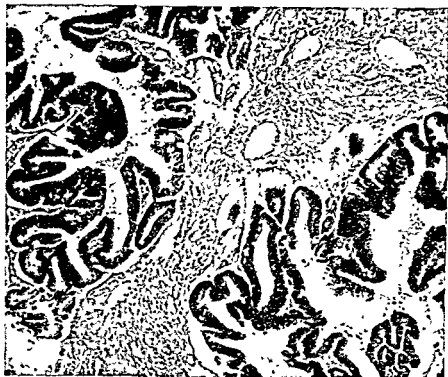


FIG. 385. Malignant papilloma of cystadenocarcinoma of ovary.



grossly typical of malignancy, only to find that microscopically the papillomata appeared to be surprisingly benign and that the patient remained clinically well. Hence,

it is our custom to give all patients with symptoms suggesting disseminated papillary ovarian carcinoma the benefit of the doubt and to perform, if possible, a radical operation.

### CARCINOMA IN DERMOID CYSTS

Carcinoma in dermoid cysts is rare but occasionally occurs as the result of malignancy arising in the epidermoid elements.

### METASTATIC OVARIAN CANCER

Metastatic ovarian cancer may be secondary to many primary sources, but the most common sources are the uterus and the gastrointestinal tract. It may be impossible at the operating table to determine the origin of advanced carcinoma of the ovaries, if they are involved in massive abdominal growths. The microscopic picture of the secondary cancer may reproduce that of the original growth; often, however, the histologic picture of the specimen obtained by biopsy is not sufficiently distinctive to permit one to form an opinion as to its origin. There is a special type of ovarian cancer, secondary usually to gastrointestinal neoplasm, known as the Krukenberg tumor, in which the cancer cells, regardless of their primary source, assume distinctive characteristics. Histologically, this type appears to be almost more closely related to sarcoma than to carcinoma; the primary neoplasm certifies it as carcinoma. Signet-ring cells with eccentric nuclei are found in a fibrous or myxomatous stroma. Such tumors, which

in the majority of cases are bilateral, are quite characteristic in their gross appearance (Fig. 386). They are solid and have a tendency to retain the general shape of ovaries, reproducing on a grand scale the surface convolutions seen in normal ovaries. Even when they have attained considerable size, they are apt to remain free, without attachment to surrounding structures. On gross section they appear to be fibrous or gelatinous. Surgically, the essential point to bear in mind when a tumor of such appearance is encountered is the necessity of exploring the intestinal tract, particularly the pylorus, for the primary tumor. The removal of these secondary tumors is usually simple, and if they are encountered at the operating table they may be removed to relieve pelvic discomfort, even though a cure of the malignancy is obviously out of the question.

Today when oophorectomy is common in connection with carcinoma of the breasts, it is surprising how frequently carcinoma is found in the ovaries. Rarely, breast cancer in the ovaries will take the histologic form of the Krukenberg tumor, but in most instances the adenocarcinoma of the breast is reproduced in the ovarian metastases. These metastatic sites in the ovary are seldom solitary but only one of the multiple metastases.

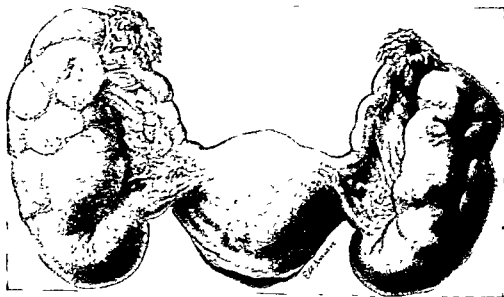


FIG. 386. Bilateral Krukenberg tumor secondary to carcinoma of the stomach.



## SARCOMA

Sarcoma of the ovary is rare but may occur at any age. In the early stages the solid tumor may resemble the fibroma. Later, when it breaks through the capsule and becomes obviously malignant, it is difficult to distinguish it at the operating table from carcinoma. Sarcoma is much less apt to be bilateral than is carcinoma. The treatment is hysterectomy, double salpingo-oophorectomy; the prognosis is poor.

## TERATOMAS

Teratomas of the ovary are distinguished from dermoid cysts in that their elements are derived from all three germ layers. They are solid or semisolid. Teratomas may make their clinical appearance at any age, and a large proportion of them occur in children. Upon opening them, the presence of bone or cartilage usually indicates their identity. True teratomas are very malignant and recur in spite of radical surgery. Their response to irradiation is also poor. However, there are some less-malignant tumors that should be classified as teratomas. Among these are the tumors that contain thyroid tissue. Small bits of thyroid tissue are not uncommon in dermoids, but in rare instances dermoids are found to contain large masses of thyroid tissue. There are a few reported instances of hyperthyroidism due to the activity of the thyroid tissue in the ovarian tumor, and this fact should be kept in mind in all instances of hyperthyroidism in which an ovarian tumor is present.

## DISGERMINOMAS

Disgerminomas are rare ovarian tumors that were thought by Meyer to arise from undifferentiated cells that are present in the early undifferentiated gonads. Figure 387 shows a typical microscopic picture. They are solid growths but, like other very cellular growths, they frequently have softened areas due to degeneration. When small, they are well encapsulated; the larger ones break through the capsule and show undoubted gross evidence of malignancy. Although on section they have a yellowish color, they may be very difficult to distinguish from other cellular malignant ovarian tumors. One im-

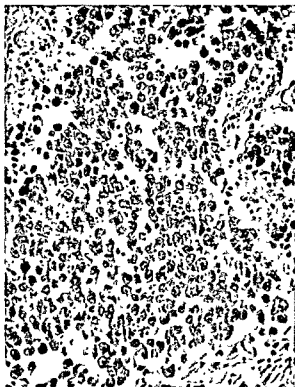


FIG. 387. Typical cellular structure of disgerminoma.

portant clinical fact is that these tumors frequently occur in women with some degree of sexual immaturity and also in real pseudohermaphrodites. They also occur early in life. The extremes of age in our laboratory reported by Novak are 6 to 38 years. Disgerminomas always should be suspected when an ovarian tumor is discovered in a young, sexually underdeveloped woman. Since they so frequently occur during childhood, the question of radical surgery becomes a serious one.

No one has followed a large number of women who have been victims of these tumors for a sufficiently long time to be certain of the degree of their malignancy. There is some evidence that some are of a rather low-grade malignancy, but others have been encountered that are highly malignant. A unilateral salpingo-oophorectomy is probably permissible in very young women, when the tumor is small. If there is evidence of breaking through of the capsule, radical surgery is indicated, regardless of age. Meyer is of the opinion that they are resistant to irradiation.

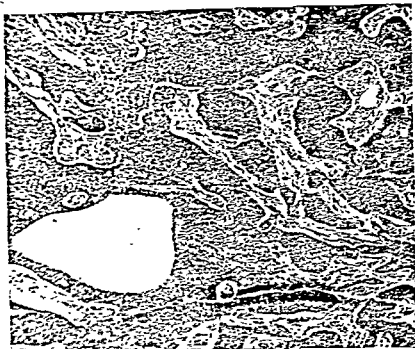


FIG. 388. Typical granulosa-cell ovarian tumor.

## FUNCTIONING TUMORS OF THE OVARY

### FEMINIZING GROUP

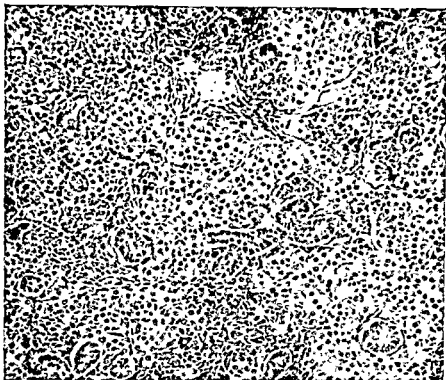
Granulosa-cell carcinoma, thecoma and luteoma comprise a group of functioning ovarian tumors that have a feminizing influence. Often they may be suspected preoperatively by the development of signs and symptoms dependent on their property of secreting the estrogenic hormone. The commonest of these three tumors is the granulosa-cell tumor and, although the literature of the past several years has given much publicity to these tumors, they must be considered as relatively rare in occurrence. When they occur in young children, they bring about the premature appearance of changes commonly associated with puberty, namely, growth of breasts, growth of pelvic and axillary hair, development of the external genitalia and the uterus beyond the age of the child and menstruation. When the tumor appears during the years of normal menstrual life, there is no change in the secondary sexual characteristics that already have developed completely, but often the menstrual cycle is disturbed in the form of excessive menstruation or long periods

of amenorrhea. However, in some instances, the menstrual cycle is unchanged. Postmenopausally, the tumors are often, though not always, associated with bleeding, and in some instances this bleeding is periodic, simulating normal menstruation. The postmenopausal uterus also grows and resumes a size comparable with that of a woman in her active menstrual life.

The effect of excessive estrogen on the endometrium usually creates the typical Swiss-cheese pattern of hyperplasia, both in menstruating and postmenopausal women. However, postmenopausal hyperplasia is by no means always indicative of such a growth. In some of the luteinized tumors progesterone as well as the estrogenic hormone is secreted, and the effect on the endometrium is the formation of a decidua-like picture. When endometrial curettings show decidua-like changes without chorionic villi, the possibility of a luteinized feminizing tumor as well as the possibility of tubal pregnancy must be considered.

Granulosa-cell tumors are usually of moderate size, but occasionally they have been reported of such a size as almost to fill the abdomen (Plate 6). We have encountered tumors of microscopic size in

FIG. 389. Arrhenoblastoma, showing sections of tubules and lighter-staining interstitial cells.



routine histologic examination of the ovaries, the histories of the patients suggest that even these very small tumors are endocrinologically active. While these tumors are usually solid, they are not as solid or as firm as fibromas. Often the tumors have a spongy feel due to numerous cavities and areas of degeneration (Fig. 388). The tumor usually breaks through the capsule at a late stage in its development; however, some of the largest tumors are still perfectly encapsulated. On section, the granulosa-cell tumors are generally grayish yellow in color and quite vascular.

The closely related theca-cell tumors are generally firmer, due to more fibrous tissue. Functionally, they cannot be distinguished from the true granulosa-cell tumors.

Luteomas are considered by Novak and others to be simply granulosa-cell tumors in which a certain amount of luteinization of the granulosa cells has taken place. The endometrium may show progesterone effect, although this is not always true. Grossly, the tumors can scarcely be distinguished from the granulosa tumors, but on section they have a more definite yellow color.

This entire group of feminizing tumors is to be regarded as malignant, although

the experience of the majority of authors would indicate that they are not as malignant as most ovarian cancers. The 5-year cure rate is relatively high, but in the past few years we have seen recurrences 13, 16 and 20 years after the removal of the original tumor. A comparison of the recurrent tumor sections with those on file in our laboratory of the original growths indicates that the tumors were recurrences of the original ones removed. Furthermore, in one case in which the uterus has been left in at the first operation, the recurrence caused postmenopausal bleeding. In general, we believe that a complete pelvic operation should be done when the tumor is recognized at the operating table. Since the grade of malignancy is relatively low in many of these tumors, unilateral salpingo-oophorectomy is sometimes justifiable if the tumor occurs in a young girl.

#### MASCULINIZING GROUP

Arrhenoblastomas occur much less frequently than the feminizing tumors and are really among the rarest of ovarian neoplasms. Histologically, they are usually a combination of tubules and interstitial cells (Fig. 389). Those tumors in which the

interstitial cells predominate usually produce the most marked masculinizing tumors. Arrhenoblastomas have been reported as occurring from the ages of 10 to 60 but are commonest in the decade of 20 to 30. Clinically, the patients first show signs of defeminization. The breasts atrophy, amenorrhea sets in, and there is a loss of subcutaneous fat, changing the body contour from the feminine to the masculine type. Later, true masculinization begins with the growth of an excessive amount of hair, hypertrophy of the clitoris and a deepening of the voice. The finding of an ovarian tumor in a woman with these remarkable changes should immediately cause one to suspect an arrhenoblastoma. At operation arrhenoblastomas are usually rather small, but tumors the size of grapefruit have been described. They are generally quite solid, although areas of degeneration may soften them in places. Even the larger tumors are well encapsulated. In spite of this, some of these tumors have proved to be malignant. However, like the granulosa-cell tumors, they are in general less malignant than most ovarian cancers. One must be cautious in forming an opinion regarding the degree

of malignancy, because so little time has elapsed since this rare tumor was recognized as a pathologic entity. Generally, radical surgery should be done, but, as in granulosa-cell tumors, when a small encapsulated tumor is found in a young individual, a unilateral salpingo-oophorectomy is permissible.

Adrenal tumors of the ovary are extremely rare; a few have been reported that are histologically similar to adrenal cortex and are associated with masculinization.

### GYNANDROBLASTOMA

In 1930 Robert Meyer suggested this name for a tumor composed of cells which were compatible with granulosa-cell tumor and also arrhenoblastoma. The patient had evidence of masculinization and at the same time hypertrophy of the uterus. Since then several tumors have been described which resemble Meyer's histologically or clinically but few that satisfied both histologic and clinical requirements. The origin of these tumors is as uncertain as their contradictory hormonal manifestations. These tumors are mentioned briefly in this *Operative Gynecology* with the hope of alerting the operat-



FIG. 390. Typical parovarian cyst, thin-walled with prominent blood vessels in the wall.

ing gynecologists so that with increased material for histologic, hormonal and clinical study eventually a better understanding of these rare tumors may be forthcoming.

### PAROVARIAN CYSTS

Parovarian cysts (Fig. 390) are not uncommonly encountered in gynecologic surgery. They arise from the vestigial remnant of the sexual portion of the wolffian body. In the mesosalpinx between the tube and the hilum of the ovary, often one can see with good illumination the vestigial remnant of the main wolffian duct which runs more or less parallel with the tube and then curves inward and downward toward the uterus. It descends in the broad ligament parallel with the cervix and finally terminates at variable levels in the anterolateral portion of the vagina. The outer end of the wolffian duct may be dilated into cysts of Morgagni which lie near the fimbriated end of the tube. These cysts seldom give rise to clinical symptoms, but on rare occasions we have seen such a cyst twisted on its pedicle, causing acute pain and necessitating laparotomy. Coming off the main wolffian duct, at right angles, are several small ducts (the parovarium) within the broad ligament. From these, or from the main duct, cysts may arise which vary in size from 1 or 2 cm. to an enormous size filling the abdomen like a huge ovarian cyst. The very large cysts are rare. The parovarium cyst is usually thin walled (Plate 6) and easily identified by its position within the leaves of the broad ligament, with the tube lying stretched over it. To identify it further, the ovary is found intact or flattened out on the side of the cyst. Parovarian cysts are usually unilocular and filled with clear straw-colored fluid. Very rarely do they have a papillary tendency, and we have encountered malignancy on only one occasion.

### BILATERAL POLYCYSTIC OVARIES STEIN-LEVENTHAL SYNDROME

Polycystic ovaries have been recognized clinically for many years, but it remained for Stein and Leventhal in 1935 to correlate this ovarian picture with a clinic syndrome. The ovaries are usually enlarged

from 2 to 3 times normal size, but in some cases the enlargement is very slight. The ovaries are smooth, lacking the wrinkled appearance of normal ovaries; they are whitish in color, due to the thickened fibrotic capsule. At first there was considerable skepticism as to the existence of this syndrome, but increased experience has convinced most gynecologists that it is a clinical entity and does respond to therapy. The symptom most commonly present is amenorrhea. It is usually secondary in character. After puberty the periods may be quite regular for a time, or there may be periods of menometrorrhagia. Then the menstrual intervals become lengthened, and the flow becomes scantier. Long periods of amenorrhea usually develop eventually. Since there is no complete ovulation, sterility is inevitable as long as the ovarian condition remains unchanged. Basal temperature charts and endometrial biopsies confirm the lack of ovulation. Some hirsutism is the rule. Discomfort in the pelvis occasionally occurs, and, instead of amenorrhea, menometrorrhagia may be present. Obesity, underdevelopment of the breasts and acne may be part of the picture. In short, the picture is that of a sexually unattractive girl with an abnormal menstrual pattern.

The basal metabolic rate is usually normal. The 17-ketosteroids are normal or slightly elevated. The basal temperature does not show the rise noted with ovulation and should be recorded for a period of time for comparison after treatment. Endometrial biopsies show no evidence of ovulation.

The ovarian enlargement often cannot be determined satisfactorily in many cases by bimanual examination. Stein reports that in over one half of his cases the bimanual examination failed to demonstrate enlarged ovaries when they were actually present. Obesity may be responsible for this in many cases, although Stein states that not over 15 per cent of his women were classified as obese. To determine the size of the ovaries Stein advocates gynecography and especially pneumoroentgenography. In our clinic we have preferred culdoscopy, perhaps because we are more experienced with this procedure than with pneumoroentgenography, but it does have the advantage of allowing one

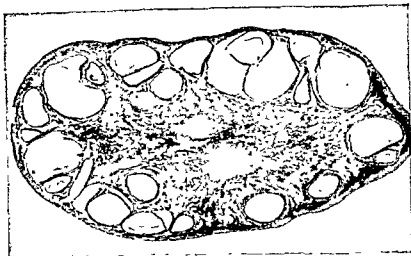


FIG. 391. Typical follicular cystic ovary from a woman with Stein-Leventhal syndrome.

to determine the absence of a corpus luteum, which is necessary to a diagnosis of this syndrome.

#### TREATMENT

Stein and his associates believe that there is no therapy for this condition except surgery. Some authors have recommended stilbestrol therapy, but the results are not convincing. Stein practices wedge resection of the ovaries, removing much of the polycystic tissue and puncturing cysts from within in the remaining ovarian tissue. The edges of the remaining ovarian tissue are then approximated with fine catgut. Other surgical procedures that have been carried out are splitting of the ovary, decapsulation and multiple punctures. The purpose of these procedures is stated to be decompression of the ovaries to permit ovulation. Regardless of what surgical procedure is carried out, it is difficult to comprehend how the fundamental physiology of the ovary can be altered. Even the wedge-shaped resection is merely a quantitative removal of part of the abnormally functioning ovarian tissue. Decapsulation which removes the thickened ovarian tissue would only leave the opportunity for surgical scar tissue to replace the previously thick tunica albuginea.

In spite of these theoretical objections, almost everyone who has had a substantial experience with this condition reports quite satisfactory results. It is probably best to consider Stein's results because one can be

sure that his cases have been picked with great adherence to the proper criteria. A return to normal menstrual cycle was the rule, and of 62 married patients 88.7 per cent became pregnant. One cannot help wondering what the percentage of pregnancies would have been without therapy. For example, we have had the opportunity of observing a woman with this syndrome over a number of years without surgical treatment. Observation and biopsy of the ovaries were taken in the course of an appendectomy. Histologic examination of the ovary confirmed the diagnosis. After 15 years of marriage and several years after all attempts at therapy had been given up she became pregnant and had a normal child. Instances such as this make it extremely difficult to evaluate the results of any type of therapy. Stein also reports that 89.3 per cent of 75 patients operated on had normal menstrual function restored. Here, again, the frequent spontaneous return to normal menstrual function of amenorrheic and menorrhagic women without treatment makes evaluation of treatment very difficult. Growth of the hypoplastic uterus was noted by these authors after surgical treatment, but hirsutism was not usually affected favorably.

With increased personal experience some of the skepticism expressed in the previous paragraph has lessened. It is always difficult to assay the results in therapy for a condition of this sort, but our personal results with wedge resection in carefully chosen

cases of Stein-Leventhal syndrome have been most gratifying. We have had the satisfaction very recently of seeing one of our treated cases request sterilization after her third cesarean section.

### GENERAL CONSIDERATIONS REGARDING THERAPY

The question of ovarian ablation as prophylaxis against ovarian neoplasms is discussed in the chapter on myomata, since it is in connection with removal of these benign tumors that this question usually arises.

The value of the admonition that all ovarian neoplasms should be operated on depends on the ability of the examiner to distinguish between ovarian enlargement due to neoplasm and enlargement due to multiple small follicular cysts or single follicular or corpus luteum retention cysts. To distinguish these latter cysts from small neoplastic ovarian enlargements is not always easy, but it is important because of the possibility of malignancy, present or future, in all neoplasms of the ovary. Retention cysts often disappear spontaneously, and their immediate removal would subject the patient in many instances to useless laparotomy. Multiple cystic retrogressing follicles may increase the ovary to 2 or 3 times the normal size. Such ovaries usually feel semisolid, and the surface is slightly nodular due to multiple small cysts. Single retention cysts are usually thin walled, often *easily compressible, but at times they are tense*. A thick-walled cyst is more apt to be neoplastic. Tumors that feel cystic in some areas and solid in others are often malignant. A solid or cystic tumor with a nodular, irregular contour is frequently malignant. The solid smooth-surfaced tumor may be malignant but may also be a fibroma. The ovarian enlargement which is adherent should be viewed with suspicion of malignancy. It is true that the fixation of the tumor mass may be due to an accompanying pelvic infection of endometriosis, but the solid fixation and induration dependent on the extension of neoplastic tissue into surrounding structures has a characteristic feeling. It is difficult to describe this, but once felt, it is usually recognized easily. In spite of the greatest tactile skill, there are

occasions when doubt will exist as to whether an ovarian enlargement is due to a retention cyst or a neoplastic cyst. Such cases should be watched at monthly intervals. Retention cysts may persist or disappear; the true neoplasm usually can be eventually detected due to increase in size. The palpation of irregularities on the surface of the tumor is cause for suspecting papillary outgrowths that indicate neoplasm, and one should bear in mind that all papillary tumors are potentially malignant. When one becomes reasonably certain that one is dealing with a neoplasm, a laparotomy should be done. When considerable doubt exists, culdoscopy may be helpful in making the decision.

Because ovarian neoplasms often grow silently, it is common to have the patient present herself for examination with signs of advanced ovarian malignancy. The silent growth of ovarian neoplasms constitutes one of the greatest reasons for periodic routine pelvic examinations. In spite of the truth of this statement the outlook is frequently bad, even when tumors are discovered on routine examination on symptomless women. Twombly reports on 40 such patients. None of them survived 5 years, and 50 per cent were dead within 9 months. Abdominal pain or abdominal enlargement is the symptom that frequently brings the patient to the physician. These symptoms often mean spreading of the neoplasm beyond the ovaries with peritoneal implants and ascites. Pemberton found that 36 per cent of the ovarian carcinomata were inoperable when first seen. The question of laparotomy, when there is obvious advanced ovarian cancer, should usually be answered in the affirmative. When the patient's condition is very poor, peritoneoscopy with biopsy to confirm the diagnosis may suffice, but when the patient's general condition warrants it, she should be given the benefit of a laparotomy. Not infrequently a seemingly inoperable growth may be removed completely or nearly completely, and the patient remain well for years. The cure of a patient by incomplete removal of a malignant growth seems to be contrary to the usual principles of surgery and pathology, but we have observed cure even without postoperative ir-

radiation. Furthermore, there is a group of papillary ovarian tumors that implants small papillary growths in a widespread manner over the peritoneum. These tumors are associated with marked ascites. Before operation, and even at the operation, they cannot be distinguished with certainty from truly malignant tumors, and yet after a complete pelvic operation with removal of the parent tumor the implants retrogress, and the patient remains permanently well. To refuse surgery in such a case, on the grounds that the ascites indicates inoperability, might withhold from the patient the chance of a permanent cure.

Benign unilateral ovarian neoplasms may be cured by unilateral oophorectomy or salpingo-oophorectomy, and this is the proper therapy in young individuals, provided that the opposite ovary appears to be normal. The tendency of certain types of benign ovarian tumors to bilaterality is discussed earlier in this chapter where the peculiarities of each type of tumor are considered. Suffice it to say here that the opposite ovary should be examined carefully for evidence of a small growth. In case of doubt, a biopsy and frozen section may be advisable. In menstruating women of 40 or over the preservation of the opposite ovary, although desirable, is not as essential as in younger women, and one would remove the opposite ovary on less evidence than would be required in a younger individual. It is a good rule to have an assistant in the operating room open every apparently benign ovarian cyst after removal. If intracystic papillomas are found with an appearance even slightly suggestive of malignancy, a frozen section should be made, especially in younger women in whom the preservation of the remaining ovary is very desirable. After the menopause, it is our custom to remove the opposite tube, the ovary and the uterus, even though the unilateral tumor is benign, provided that the patient's condition does not contraindicate the necessary added surgery.

When the ovarian neoplasm is obviously malignant, a hysterectomy and a double salpingo-oophorectomy are done routinely, except in the rare cases, as indicated in the discussion of the special groups of ovar-

ian tumors. The importance of removal of both ovaries in all cases is emphasized by the findings of Norris and Murphy. These investigators discovered that when one ovary was grossly malignant at operation and the other grossly benign, in 17.5 per cent the benign-appearing ovary proved to be malignant when examined histologically. The pathologic findings of Munnell and Taylor confirmed the discovery of Norris and Murphy. A total hysterectomy is preferred to subtotal, but in some instances, when the tumors are fixed and the operation difficult, it is wise to do the lesser operation, rather than increase the operative risk by removing the cervix. In such cases when the neoplasm has infiltrated surrounding structures so that the operation is obviously incomplete anyway, the removal of the cervix would not influence the prognosis.

Inasmuch as the omentum is the most common recipient of implantations and metastases of ovarian cancer, Pemberton has recommended omentectomy as a routine procedure in all cases of ovarian malignancy when there is a reasonable chance of cure. Frequently, we have done this and have been surprised on occasions to find microscopic carcinoma in a grossly normal-appearing omentum.

The importance of radical surgery in the treatment of ovarian cancer cannot be emphasized too strongly. The number of patients with unilateral ovarian carcinoma on whom conservative surgery is done is appalling. Sometimes incomplete surgery is done because of failure on the part of the surgeon to recognize the malignancy, but in some instances there is apparently a failure of the surgeon to recognize the importance of radical surgery. One is surprised, for example, by the report of Munnell and Taylor that in the Sloane Hospital for Women conservative surgery was found to have been done in exactly half of the patients with unilateral ovarian cancer. The amazing fact which came out of their study was that the 5-year-cure rate was approximately equal for the radical and the conservative groups. In spite of these results one should not conclude that unilateral oophorectomy is adequate treatment. It is obvious that the mistake of conservative



FIG. 392. Gangrenous section of transverse colon caused by pocketing of radioactive gold.



surgery was much more likely to have taken place in the early cases, with better prognosis. Furthermore, the finding of microscopic cancer on histologic examination of the apparently normal ovary in some cases in whom radical surgery was done indicates that the survival rate of the conservative group would have been significantly increased had they been treated radically.

The value of x-ray therapy in ovarian carcinoma has been the subject of controversy among gynecologists for decades. The fact that the discussion continues in spite of the fact that x-ray treatment has been used for many years indicates that the results are not very decisively favorable. The literature is contradictory. Some irradiation therapists acclaim its value both as a palliative and as a curative agent. Most gynecologists use it postoperatively without very definite conviction of its value, and a few even believe that the sequelae outweigh the possible benefits.

We have shared the skepticism of many gynecologists as to the value of postoperative x-ray therapy. Nevertheless, we have seen a few near miracles following the use of x-rays. When the metastatic growth is very widespread throughout the peritoneal cavity and particularly when the patient's general condition is poor, it is our belief that to x-ray the abdomen generally only adds insult to injury and makes the remaining days of life more miserable for the patient. When we know or suspect from the adherence of the tumor in the pelvis that we have not removed all the malignant tissue we use postoperative x-ray therapy.

In such cases there is a definite target to aim at, and it seems rational that there might be benefit. We also irradiate those cases in which the growth appears at operation to be completely limited to the ovaries but in which the histologic degree of malignancy is high. We do not irradiate those cases of histologically low-grade malignancy when the growth is entirely limited to one or both ovaries and when there is good reason to believe that a complete operation has been done. Such a patient should be watched carefully at intervals of 2 to 3 months, and if any evidence of recurrence is detected irradiation should be started at once.

The question of radioactive colloidal gold as an adjunct to surgery is still controversial. Most observers agree that in those cases associated with ascites, the formation of fluid is slowed by the use of gold. There is no real evidence to support the view that radioactive gold is curative if viable cancer has been left at operation. Keettel and Elkins undertook a study of the fluid from the cul-de-sac at operation searching for abnormal cells. If there was no ascites, saline solution was injected into the cul-de-sac, thoroughly agitated and then aspirated. Among 35 histologically benign tumors, abnormal cells were found only once. Of 20 malignant tumors, 13 had abnormal cells in the fluid. In most cases the finding of cells was primarily of academic interest, since malignancy was evident from gross inspection. However, in 5 positive cases there was no visible break-through of the tumor, no free fluid and no peritoneal implants.

The finding of abnormal cells in cases with no gross evidence of disseminated malignancy might encourage one to use radioactive gold. It is our belief that when gross implants are present one can expect little curative effect from intraperitoneal gold, since a ray penetration of 2 mm. or less is all that can be expected. When in the opinion of the operator there is a possibility of using gold it is well to leave 2 or 3 small polyethylene tubes in the pelvis and bring them out through the incision. This would appear to be much safer than injecting the gold through an abdominal puncture. Figure 392 shows the possible result of this blind procedure. Either the injection was made directly into the wall of the transverse colon or the gold formed a pool at that point, causing necrosis of a segment of the bowel. Probably the chief indication for

gold is a case with marked ascites in which it would be given only with the thought of decreasing the speed of formation of ascitic fluid.

Chemotherapy to date has offered no convincing evidence that it is of value in treating ovarian cancer.

### PROGNOSIS IN OVARIAN CARCINOMA

Statistics on 5-year "cures" for carcinoma of the ovary vary greatly. The following table, compiled from the literature, emphasizes this point. This table, which appeared in the first edition of this book, is left unchanged because a review of recent statistics shows no real progress in treating this disease.

A glance at those statistics will show a variation ranging from 65.4 per cent to 6.3

TABLE 10. STATISTICS OF VARIOUS AUTHORS, 5-YEAR CURE RATES IN CANCER OF THE OVARY

AUTHOR	YEAR	NUMBER OF CASES	FIVE-YEAR CURE RATE (PER CENT)
Straussman	1921	17†	8.5
Schafer	1922	70*	13.0
Ford	1928	59†	28.8
May	1930	†	31.0
von Peham and Amreich	1930	115*	9.5
Heyman	1932	134†	31.3
Anspach	1934	24	29.1
Norris	1934	44	50.0
Harris and Payne	1935	51*	51.0
Murphy	1935	92†	24.0
Lynch	1936	64	35.5
Jacobs and Stenstrom	1937	31	35.4
Counsellor	1940	143*	65.4
		118†	50.5
		36†	16.7
Meigs	1940	154	15.5
Pemberton	1940	114	32.0
Jones	1941	30	23.3
Walter, Bachman and Harris	1941	63*	6.3
		61†	22.9
Taylor and Greeley	1942	138	15.2
Helsel	1946	100	20.2
Campbell and Singman	1947	69	13.0
Swinton and Yancey	1947	45	14.0
Munnell and Taylor	1949	200	27.5

\* Surgery alone.

† Surgery and x-ray therapy.

‡ X-ray therapy alone.

per cent. It is interesting that in these two extreme groups surgery alone was used. It scarcely seems possible that a difference in the quality of surgery could be responsible for this wide variation in results. Since in carcinoma of the ovary we are dealing with a variety of types of cancer with varying degrees of malignancy, it is obvious that the end results will differ, depending on the percentages of the different types of tumors in the reported groups. Granulosa-cell tumors and arrhenoblastomas are of relatively low-grade malignancy, and it is not reasonable to compare the results of a series including these with a series from which they have been excluded. Perhaps the greatest variable factor in the statistics is the difference in interpretation of malignancy of the papillary tumors. It seems obvious in examining some of the pictures of these tumors in some of the reported series that many benign papillary cystadenomas have been counted as malignant.

#### THE MANAGEMENT OF OVARIAN CYSTS DURING PREGNANCY

The finding of an ovarian enlargement during pregnancy is not an infrequent experience of most gynecologists and obstetricians. The reported incidence of ovarian cysts in pregnancy varies greatly. Falk and Bunkin, on averaging several reports in the literature, found cysts to occur once in 2,500 pregnancies. On the other hand, Mathieu and Holman found ovarian enlargement once in 102 pregnancies. A recent report by Haas of Ann Arbor records one ovarian cyst in 316 pregnancies. The great variation is almost certainly to some degree dependent on differences in interpretation of what constitutes ovarian enlargement. Haas has suggested that cystic enlargements of less than 5 cm. should not be considered, since these are often indistinguishable from normal ovarian variations. This would appear to be a good working rule, bearing in mind, however, that all neoplasms of the ovary must at one stage be less than 5 cm. in diameter. The detection of an ovarian cyst depends on the stage of the pregnancy. For example, functioning corpus luteum cysts tend to disappear as the lutein tissue regresses with advancing pregnancy. Also, late in preg-

nancy cysts are usually drawn up into the abdomen, and their detection by bimanual examination may be impossible.

The questions that the examiner should attempt to answer and upon which his ultimate decision rests are:

1. Is the cyst a functioning cystic corpus luteum or a neoplastic cyst?
2. What is likely to happen to the cyst in the course of the pregnancy?
3. Is the presence of the cyst apt to complicate the course of the pregnancy or the delivery?
4. What will be the effect of removal of the cyst on the pregnancy?

The general rules mentioned earlier in this chapter regarding differentiation between retention cysts and neoplasms apply equally during pregnancy. Since the differentiation in young women often lies between a retention cyst and a small dermoid, a roentgenogram may be useful if the dermoid happens to contain a tooth. Culdoscopy may prove to be of great value. Under local or Pentothal Sodium anesthesia it will seldom, if ever, disturb the pregnancy. If one can ascertain that the ovarian enlargement is due to acystic corpus luteum, one can refrain from surgery, and the cyst will regress as the pregnancy advances. If the cyst appears to be a smooth-walled benign neoplasm, one can defer removing it until the 2nd trimester of pregnancy, when its removal will almost certainly not disturb the pregnancy, even though the corpus luteum is removed. If there is a suggestion of papillomatous growths on the exterior of the cyst or other evidence of possible malignancy, surgery should be done immediately, regardless of the possible consequences to the pregnancy. Haas has reported on the nature of 25 cysts occurring in pregnancy, and it is well to bear in mind his figures, as they give some indication of the pathologic possibilities.

Functioning (corpus luteum)	2
Neoplastic	10
Endometrial	2
Parovarian	1
Simple cyst	1
Unknown (not removed)	9
Total	25

Of the neoplastic cysts only two were malignant.

The majority of cysts complicating pregnancy cause few, if any, symptoms. In some instances there is slight discomfort but not sufficient to demand removal for relief. Twisting, rupture and hemorrhage may occur, but they are infrequent. Severe pain indicative of one of these complications calls for immediate surgery.

The presence of an ovarian cyst apparently has little effect on the incidence of abortion. There were no abortions in Haas' 25 cases and only 12 per cent of threatened abortions. It would thus appear that the increased danger of abortion would scarcely be a factor in influencing one toward surgery.

As pregnancy progresses, ovarian cysts are usually carried high up into the abdomen, where they have no adverse effect on the course of labor. When they are of considerable size and remain deep in the pelvis, they obstruct the descent of the child's head. If such a cyst is not dislodged easily, cesarean section and removal of the cyst should be done.

Removal of the cyst with the corpus luteum of pregnancy carries with it a definite risk of abortion during the 1st trimester of pregnancy. Valuable information regarding the location of the corpus luteum in the affected or normal ovary may be obtained by culdoscopy. If the corpus luteum is located in the normal ovary, usually the cyst may be removed with impunity. With good modern anesthesia and reasonably careful handling of the pregnant uterus at the operating table, the likelihood of abortion resulting from removal of a non-functioning ovarian cyst is very slight. As a rule, surgery should be deferred until the 2nd trimester of pregnancy, unless malignancy is probable or some complication such as torsion occurs. The removal of the corpus luteum during the 2nd trimester usually can be done with impunity. When removal of the corpus luteum of pregnancy is unavoidable, progesterone, administered in large dosage, may be of value. Although we realize that its use is controversial, on occasion we have brought patients through pregnancy after removal of the corpus luteum early in the

1st trimester. It is always difficult to be certain whether pregnancy would have continued without treatment, but our experience would suggest that it is worthy of a trial.

From the above discussion it would appear that each case in which an ovarian cyst is encountered during pregnancy should be evaluated carefully, making an attempt to learn as much as possible about the nature of the tumor and weighing carefully the considerations for or against its removal as well as the optimum time.

### TECHNICAL POINTS IN OVARIAN SURGERY

In most instances the removal of a benign ovarian cyst is among the simplest of surgical procedures. In some instances the mesovarium constitutes the pedicle of the cyst, and simply clamping, cutting and ligating this pedicle are the entire operation. In more instances, however, cysts that require removal have grown to such size as to make it impractical to remove the cyst without the tube. The operation then becomes a salpingo-oophorocystectomy, and the first step is usually clamping, cutting and suturing the infundibulopelvic ligament. Clamping, cutting and suturing the remainder of the broad ligament frees the cyst up to the uterine cornu. The tube and the utero-ovarian ligament are excised from the uterine cornu with a small wedge of myometrium. This wound in the uterine cornu is closed with a figure-of-8 suture and covered over with a fold of the round and the broad ligaments. When possible, the rough stump of the infundibulopelvic ligament may be inverted by a purse string placed carefully in the peritoneum, being watchful not to injure the ovarian vessels.

When the cyst is complicated by adhesions due to pelvic infection or endometriosis, its removal may be difficult. Great care must be exercised in dissecting the cyst free from loops of bowel. When the adhesions are dense and the bowel wall intimately blended with the cyst wall, one should bear in mind the possibility of getting out of a difficult situation by splitting the layers of the cyst wall and leaving bits of

the outer cyst wall on the bowel. The outer coat is without epithelial lining, and no harm is done by leaving bits of it on the intestine.

The removal of malignant tumors may be extremely difficult when, by invasion, they are adherent to surrounding structures. It is not the best surgical judgment to abandon the job of removing a malignant ovarian neoplasm simply because it is impossible to remove it cleanly. There are too many 5-year cures, observed after incomplete removal followed by irradiation, to make this justifiable. Hence, except in cases where the intra-abdominal extension is very advanced, it is usually well to persist in the radical removal of the pelvic organs. Cutting through carcinomatous tissue causes bleeding, but such bleeding is seldom dangerous. Although such surgery is not clean-cut and is more sanguineous than one would choose, such bleeding usually can be controlled by the use of sutures or the temporary use of packs. Rarely, a cigarette drain with a raw gauze end may be required to control the bleeding.

The question of using a trocar to evacuate a large cyst, rather than making a greatly lengthened abdominal incision, often arises. In general, it is preferable to remove a large cyst intact, even though there is every indication from the external appearance of the cyst that it is benign, for there is always

the possibility of malignant papillomata within the cyst. However, exceptions must be made. An enormous cyst, filling a greatly distended abdomen, may be evacuated when it appears to be entirely benign externally. Even when a cyst is of small size but adherent, puncture may be necessary in order to permit safe dissection under sight of the cyst wall from other structures which would be unsafe if carried out blindly. In evacuating a cyst one must attempt to avoid spilling any of the cyst contents; the area about the trocar should be protected with moist gauze.

When one anticipates a difficult dissection of an adherent ovarian tumor, often much time may be saved by preoperative ureteral catheterization. By constantly being able to locate the ureters by palpation the surgeon can proceed more rapidly, and the danger of injury to the ureters is greatly diminished.

Retention cysts of the follicular or corpus luteum variety and occasionally very small neoplastic cysts, such as dermoids, may be resected, leaving a reasonable part of an ovary. This procedure is particularly desirable when one is dealing with the sole remaining ovary in a young woman. In dealing with ovarian endometriosis, resection of the invaded portion of the ovary is often desirable. In general, the author has no great

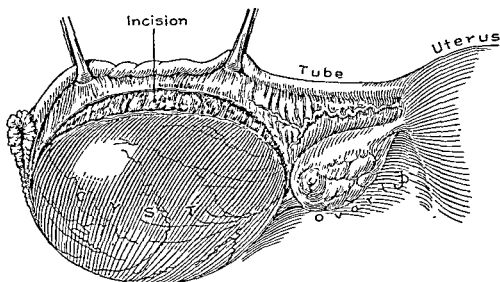


FIG. 393. Small parovarian cyst removed from broad ligament without disturbing the tube or the ovary.

enthusiasm for resection of a portion of an ovary, but occasionally it becomes the procedure of choice. The technic of resection is illustrated in Figure 366. The ovary is held in position for resection by 2 Allis clips, and the cyst is either shelled out with the scalpel handle or cut out. The wound is closed with a lock stitch of No. 0 or No. 00 catgut on an atraumatic round needle. This stitch is hemostatic and also nicely approximates the edges of the wound.

Parovarian cysts, when large, are usually

removed with the tube and the ovary. When small, they can be enucleated from between the leaves of the broad ligament without damage to the blood supply of the tube or the ovary (Fig. 393). Closure of the opening in the broad ligament constitutes peritonization. Many large parovarian cysts develop entirely between the leaves of the broad ligament without forming a pedicle. In dissecting such cysts free one must bear in mind the presence of the ureters and avoid injuring them.

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# Primary Carcinoma of the Fallopian Tube

## GENERAL CONSIDERATIONS

Primary carcinoma of the fallopian tube is one of the rarest of pelvic malignancies. The most recent report of a literature review made by Potter and Hayden showed 663 cases in the literature. Since the opening of the gynecologic pathologic laboratory and the processing of 165,000 operative specimens we have encountered 52 cases of primary tubal cancer; 26 of these were from our own service, and 26 were specimens sent in from other institutions. It is so rare that most reports are of from 1 to 3 cases. The largest series with which we are familiar was reported from the Mayo Clinic and consisted of 16.

Because of its rarity and other factors which will be discussed in this chapter, the diagnosis is seldom made preoperatively. Indeed, the diagnosis is often missed even at the operating table where the operator removes a tube which he believes to be a simple hydrosalpinx. Cures are rare, chiefly because of the difficulties of early diagnosis. The author has cured only one case of primary tubal cancer. In that case a 5-cm. adnexal mass was palpated on the left side of the pelvis in an entirely asymptomatic postmenopausal woman. After a negative barium enema it was assumed that the mass was due to an ovarian enlargement, and the patient was explored abdominally. The left ovary was entirely normal, and the enlargement, which was adherent to the sigmoid, was due to a primary tubal carcinoma. A block dissection of a segment of the sigmoid, together with a total hysterectomy and a double salpingo-oophorectomy, was done. Microscopic examination of the removed sigmoid showed infiltration with malignant cells. Obviously, hysterectomy and double salpingo-oophorectomy would

not have cured the patient, who is now clinically well 8 years after surgery with no evidence of recurrence.

From these introductory remarks one might conclude that the lesion at the time of surgery is almost universally hopeless. However, a small percentage of cures are reported in the literature, and it is possible that with some of the newer diagnostic procedures, which will be discussed in this chapter, earlier diagnoses may be made and the dark record of therapy improved.

## PATHOLOGY

Grossly, a primary tubal carcinoma may appear identical with a free floating hydrosalpinx. Indeed, it often is a tube distended with thin fluid which is in fact a hydrosalpinx. The fact that it is free from adhesions might make one sufficiently suspicious to have the tube opened for inspection in the operating room. Papillary projections will be seen growing from the wall of the tube distended with blood-tinged thin fluid. The wall of the tube may be so thinned that it is susceptible of rupture at even a gentle touch. On the other hand, we have seen tubes distended with grumous carcinomatous material with a thickened wall resembling pyosalpinx. On transecting such a tube the friable carcinomatous material may suggest inspissated pus.

Microscopically, the tumor is of the adenomatous type and usually papillary in architecture (Fig. 394). The papillary growth may outgrow its blood supply, causing sloughing of necrotic cells into the lumen.

## DIAGNOSTIC DIFFICULTIES

The lesion occurs almost entirely in women over 40 and most often postmenopausally. Hayden and Potter found the average



age to be 48. The commonest presenting complaint is the appearance of a thin blood-tinged discharge between periods or, more frequently, postmenopausally. Occasionally, the initial complaint may be abdominal pain or distention, but these symptoms usually signify advanced disease. However, some relatively early cases have given rise to pain apparently due to tubal distention. Often there may be no symptoms when the adnexal enlargement is discovered on routine pelvic examination.

Unless a mass is discovered on routine pelvic checkup, the problem resolves itself into the investigation of a woman at or beyond the menopause with scanty abnormal bleeding. A unilateral palpable mass may be felt, but in many instances no mass can be felt even under anesthesia. A vaginal and cervical cytologic smear should be taken, and a diagnostic curettage and cervical biopsy done. The curetted and biopsied tissue fails to explain the bleeding, but one is not relieved of the responsibility of further investigation. Such cases should always give

concern for they may indicate ovarian malignancy; in fact, percentage-wise they are more apt to represent ovarian malignancy than tubal.

The cytologic report may be negative, positive, or suspicious of malignancy. Since many of these lesions occur in postmenopausal women, many of whom have occluded or almost occluded cervical canals, it is obvious that the vaginal smears may be negative, even though malignant cells are shed through the tubal lumen into the uterine cavity. In fact, Hayden and Potter report negative smears in the 5 cases in their series in which cytology was done. On the other hand, Brewer and Guderman have recently reported 2 cases of primary tubal cancer and 1 of tubal cancer secondary to carcinoma of the pancreas with positive vaginal smears. In 1947 Isbell *et al.* reported what was probably the first positive smear associated with primary tubal cancer. Subsequently, Fidler and Lock, Song, Besserer, Navratil, Bret *et al.*, Deden, Frankel and Papanicolaou have all reported cases of tubal cancer de-

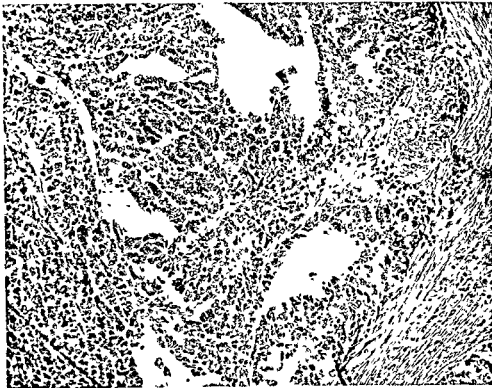


FIG. 394. Primary papillary carcinoma of the fallopian tube.

tected by vaginal smear. These results indicate that when curettage and cervical biopsy fail to explain the abnormal bleeding and the smear is positive, neoplasm of the ovary or the tube should be suspected. This statement is valid even though the adnexa are not palpably enlarged. A single positive smear, not substantiated by curettage and biopsy, should always be repeated. When persistently positive, one should of course bear in mind the possibility of a minute missed cervical or endometrial lesion and continue his search for it. Failing to locate the malignancy in the uterus, cul-de-sac aspiration for cytologic examination of the fluid might reveal malignant cells from an ovary or tube. Also, culdoscopy could reveal a nonpalpable ovarian or tubal growth.

### TREATMENT

The treatment of carcinoma of the tube is total hysterectomy and double salpingo-oophorectomy with as wide an excision of the involved tube as possible. If the lesion is adherent to the broad ligament, the latter structure, including the parametrium, should be excised as widely as possible. Lymph nodes should be palpated and, if enlarged,

a lymphadenectomy should be done. If the tube is found to be adherent to the bowel, it should be removed in a block dissection with the pelvic organs. The value of x-ray therapy has not been proved, but in view of the poor prognosis with surgery alone it would seem to be justifiable to follow surgery routinely with pelvic irradiation. It also seems to be reasonable to use radio-active gold if there is evidence of spread of the disease beyond the tube.

Since the diagnosis is extremely difficult to make preoperatively in most cases, the therapeutic problem usually resolves itself into the advisability of surgery for an adnexal mass. The answer to this is identical with that of ovarian tumors. The abdomen should be explored. With a persistently positive vaginal smear tubal carcinoma should always be kept in mind, and abdominal exploration is at times justifiable when the above-mentioned diagnostic procedures have been done. Although the prognosis is generally poor because of late diagnosis, Hayden and Potter report a 27 per cent 5-year salvage rate. Many of the cases which survive are those in which an early tubal malignancy is discovered incidental to operation for other obvious pelvic lesions.

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## Extraperitoneal Tumors Encountered in Gynecology

Retroperitoneal tumors, lying in the pelvis, are encountered not infrequently by the gynecologist. No single type of retroperitoneal tumors occurs frequently, but there are many types and, taken in the aggregate, they cannot be considered rare. They present interesting and often difficult diagnostic problems, which sometimes must be solved almost entirely on the basis of the pelvic examination. In this connection we are referring only to true retroperitoneal condi-

tions and not extraperitoneal broad-ligament fibroids or abscesses which are considered elsewhere in this volume.

The problem, generally, is whether the mass that is felt on vaginal or rectal examination arises from the generative organs or retroperitoneally. After it is decided that the mass is retroperitoneal, then an effort is made to determine its exact nature. The

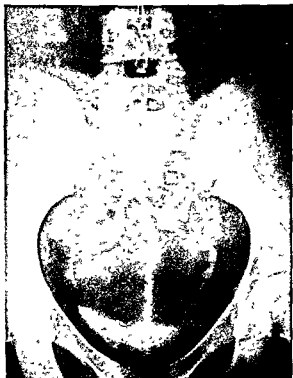


FIG. 395. Bilateral pelvic kidneys which on pelvic examination were first thought to be ovarian tumors.



FIG. 396. Retrograde pyelograms, showing unilateral hydronephrotic pelvic kidney.

retroperitoneal nature of the tumor is indicated by its fixed position, posteriorly or posterolaterally, and the identification of normal pelvic organs anterior to the mass. To decide whether the tumor mass is inflammatory or neoplastic is often extremely difficult.

Ectopic kidney or kidneys, occurring in the pelvis, are of importance gynecologically and obstetrically. The question of differential diagnosis between ectopic kidneys that are palpable vaginally and ovarian tumors arises. The solid fixed nature of the mass and the characteristic shape should make one suspect kidney. If one can palpate normal ovaries, the diagnosis becomes more certain. The greatest danger lies in not suspecting the presence of ectopic kidney or kidneys and performing a laparotomy only to discover the real nature of the mass or masses. If suspected, pyelograms will prove the position of the kidneys (Figs. 395 and 396).

Ectopic kidneys are subject to all diseases

of the normally placed organs. In fact, the incidence of disease is greater in the ectopic organs. The author has seen an acutely infected hydronephrotic, ectopic kidney lying in the cul-de-sac resembling a tubo-ovarian abscess. Only when examined under anesthesia, preparatory to pelvic puncture, was the true nature of the mass suspected.

If ectopic kidney or kidneys are discovered during pregnancy, the patient should be watched carefully during the period of gestation. In most instances cesarean section should be done rather than run the risk of damage to the pelvic kidney during labor. On one occasion the author was forced to terminate a pregnancy at 4 months due to pain from pressure of the pregnant uterus on an ectopic kidney that was situated on the pelvic brim. Later, a nephrectomy was done before another pregnancy was permitted.

Retroperitoneal inflammatory lymph glands may be suspected and diagnosed with

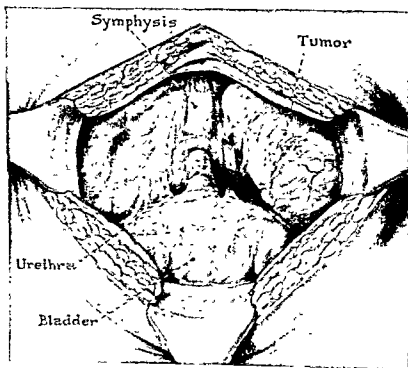


FIG. 397. Extraperitoneal fibromyoma in the space of Retzius. The tumor had no attachment to any of the adjacent organs.

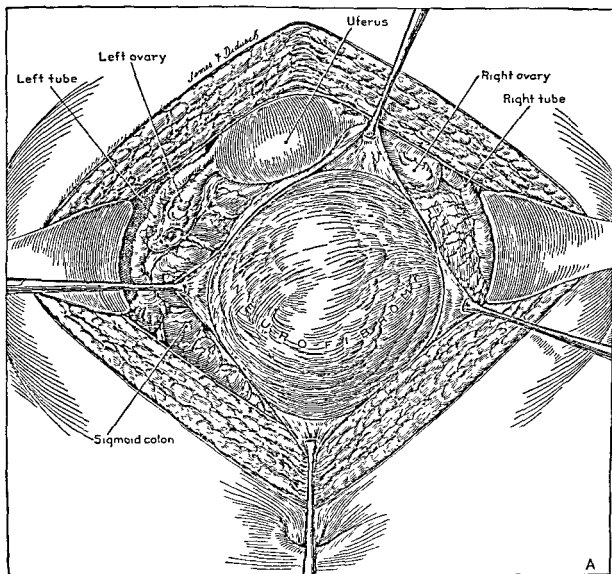


FIG. 398. Excision of a retroperitoneal pelvic tumor. (A) The incision has been made through the parietal peritoneum, posteriorly, exposing the retroperitoneal tumor.

reasonable certainty when they are felt as a fixed, irregular, somewhat tender mass lying posterolaterally in the pelvis. To substantiate the diagnosis, extraperitoneal surgical exploration and biopsy are usually required.

Retroperitoneal abscesses, arising from osteomyelitis of the pelvic bones, may present themselves as tender, fixed and sometimes fluctuant masses. With such findings a roentgenogram of the pelvic bones always should be made. However, with certain abscesses of this clinical type we have, on occasion, failed to determine the origin.

Retroperitoneal tumors of bone or cartilage are felt as very firm masses, continuous with the bony pelvis. A roentgenogram of the pelvis usually will establish the diagnosis.

Lipomas, fibromas and myomas rarely originate retroperitoneally in the pelvis. Because frequently the uterus can be differentiated from the mass, it is often thought that the mass represents an ovarian growth. If the ovaries can be felt to be normal, the possibility of the growth's arising retroperitoneally is enhanced. These retroperitoneal growths may attain a very large size and so

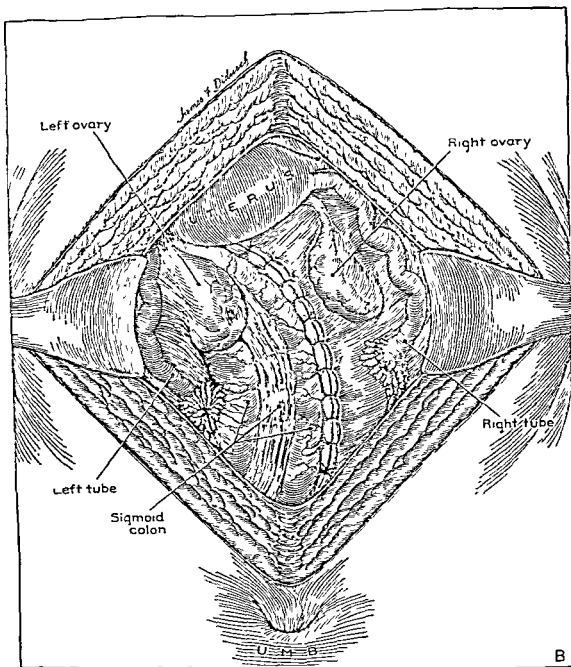


FIG. 398. (Continued). Excision of the retroperitoneal pelvic tumor. (B) The tumor has been removed, and the parietal peritoneum has been closed.

displace the generative organs as to make their identification difficult. Sarcomatous change in these tumors is relatively common. Figure 397 shows a fibroma that developed anteriorly in the space of Retzius.

Retroperitoneal masses due to lymphosarcoma may extend into the pelvis and be palpable there. The masses may be so large as to simulate a multinodular fibroid. They are, of course, fixed and not tender. The

finding of enlarged lymph glands elsewhere is a strong point in establishing the diagnosis. Biopsy of either the pelvic or other glands finally confirms the diagnosis.

Brady has reported a large retroperitoneal chylous cyst that contained milky fluid. It probably arose from the lumbar lymphatic trunk.

A small number of ganglioneuromas have been reported lying retroperitoneally and occupying the hollow of the sacrum. The tumor shown in Figure 398 A was of this type. It was entirely asymptomatic and was discovered in the course of a routine pelvic examination done at the time of fitting a contraceptive diaphragm. The tumor was the size of a large orange and lay in the mid-line, displacing the sigmoid to the left. It was enucleated easily, and the patient has remained well for 6 years, during which time she has had 2 children. The cases of

ganglioneuroma that have been reported in the literature have also proved to be benign.

The removal of this tumor was easily effected by splitting the posterior parietal peritoneum over the tumor (Fig. 398 A). The tumor was enucleated bloodlessly. In removing a tumor in this position, special care should be taken to avoid injury to the ureters and the large vessels. The posterior peritoneal incision was then closed with a continuous suture of No. 0 plain catgut (Fig. 398 B).

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## Congenital Absence of the Vagina

Congenital absence of the vagina is fortunately a rare malformation. Counseller found the condition occurring once in 4,000 female admissions at the Mayo Clinic. In the vast majority of women born without vaginas there is also the congenital absence of the uterus. Nevertheless, among 26 patients of Counseller's who were laparotomized, 4 had anatomically normal tubes, ovaries and uterus. Three had developed hematosalpinx, and 3 endometriosis. Underdeveloped uteri and bicornuate uteri are encountered occasionally, but in the majority of cases nothing can be felt in the usual position of the uterus, or there is simply a slight mid-line thickening in the broad ligament. Almost all of these patients have normal ovaries and fully developed secondary sexual characteristics. In our personal experience we never have seen a woman with a congenital absence of the vagina who was not typically feminine physically.

We have seen a few women with congenital absence of the vagina who were quite unconcerned about their condition, who had no interest in matrimony and no desire to have the condition corrected. However, this attitude is very unusual, and the majority of these individuals have a normal reaction to the opposite sex and intend to marry if possible. The knowledge of the physical defect may give them a feeling of inferiority. The individual with absent vagina is usually brought to the gynecologist at the age of 14 or 15 when the failure of the menses to appear gives the mother concern. Frank recommended the formation of an artificial vagina by his nonsurgical method early in life, for there is little, if any, tendency of a vagina thus formed to contract. He believed that the establishment of a vagina early in

life helped to combat the feeling of inferiority sometimes present in these girls. We cannot concur in this, believing that the optimum time for the correction of the condition is about 6 months before contemplated marriage.

Wharton has called attention to the frequency with which absence of the vagina is associated with congenital malformations of the urinary tract. Congenital absence of one kidney, ectopia of the unilateral kidney, horseshoe kidney and duplication of the ureter have all been described. In fact, among 41 patients of Counseller's group who were investigated urologically, only 20 had normal urinary tracts. Hence, it would seem advisable to make intravenous urograms on all women with congenital absence of the vagina, if for no other reason than to give the patient an exact knowledge of her condition.

Many ingenious operations have been devised for the formation of an artificial vagina.

During the past decade our experience has crystallized our ideas so that we believe there is only one method of dealing with the complete congenital absence of the vagina, namely, the McIndoe operation. The others are described briefly because of their historical interest.

Among the older operations is that of Baldwin in which a double loop of ileum was resected and brought down to function as a vagina. The operation carried with it a mortality which was too high to justify it. Today with antibiotic sterilization of the intestinal tract, it could be done with a much lower mortality, but still it is not justifiable because such excellent results can be obtained with the safer McIndoe procedure. In addition, the intestinal mucosa often secreted a very irritating and disagreeable discharge.



Schubert utilized the lower segment of the rectum, transplanting it anteriorly for use as a vagina. This operation also carried a high mortality; there was often damage to the rectal sphincter and frequently a resulting fecal fistula.

At the present time Shirodkar utilizes a segment of the sigmoid and claims excellent results. He believes that the mucous secretion of the sigmoid is an advantage in serving as lubrication to the vagina. In our opinion utilization of a segment of the large bowel is unjustified in view of the simplicity of the McIndoe operation. We have never had a complaint of dryness of the artificial McIndoe vagina.

The formation of an artificial canal lined by the labia minora, as described by Graves, was practiced with some success but is much more complicated than the modern skin-grafting method.

The multistage Frank-Geist "satchel-handle" operation in which pedicle flaps obtained from the inner aspect of the thigh were utilized has also been abandoned because of its multistage complicated technic.

## FRANK NONSURGICAL METHOD OF MAKING AN ARTIFICIAL VAGINA

In 1938 Robert Frank described a method of formation of an artificial vagina without operation. In 1940 he reported remarkably satisfactory results in 8 cases treated by this method. His follow-up study showed that a vagina formed in this manner remains permanent in depth and caliber, even in patients who have neglected dilatation for more than a year.

Our results in a few cases in which we attempted this method have not been very satisfactory. Great persistence and co-operation is necessary on the part of the patient which are not usually obtainable; and even in some cases in which complete co-operation is had, the cavity fails to materialize. If an occasional patient desires to attempt this rather tedious exercise, we have no objection to her trying it. Hence, the technic is described. In case of failure, a surgical procedure can be done later.

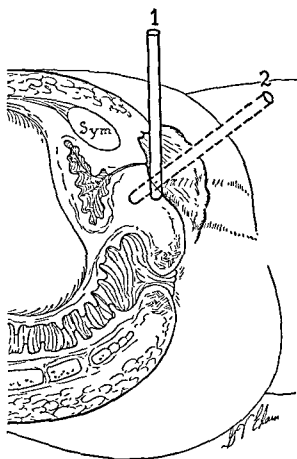


FIG. 399. Frank nonoperative method of making vagina. Diagram showing method of making pressure with test tubes. Tube 1 is directed backward and inward for the first week. Tube 2 is directed in normal vaginal axis after the first week.

### TECHNIC

The first step is important. A narrow pyrex tube, 0.8 cm. ( $\frac{5}{16}$  inch) in outside diameter, is introduced by the physician in the center of the hymenal region, in a direction backward and inward, with the patient in the lithotomy position (Fig. 399). The patient is carefully taught to perform this maneuver 3 times daily for at least a half hour for 1 week. This is important in order to stretch the mucosa so that further measures do not distort and dilate the urinary meatus. After the first week, the patient is taught to insert the tube downward and inward as before, but when this position has been attained, to change the direction of insertion in a line paralleling the normal axis of the vagina. The tube is held in place for one half hour in the morning and one half hour in the evening. Usually in from 2 to 4 weeks a suffi-

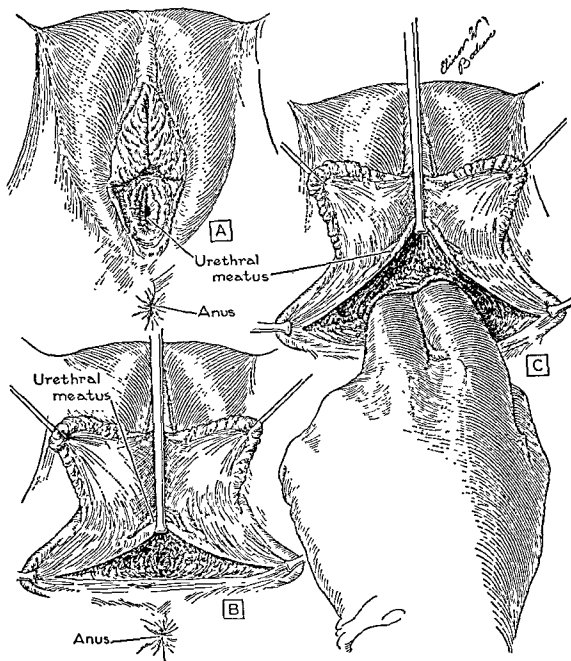


FIG. 400. Wharton operation for congenital absence of the vagina. (A) Indicates pre-operative condition, showing dilated urethral meatus. (B) Shows transverse line of incision between the urethra and the anus. (C) Indicates method of dissecting space between the urethra and the rectum, using two fingers and alternately opening and closing them.

cient depression permitting the retention of a 3-inch-long tube has been attained. The shorter tube, as soon as it can be introduced for its full length, is kept in place throughout the night by a small pad of cotton and an appropriate T-

binder. Within 6 to 8 weeks, the full length of the vagina,  $2\frac{1}{4}$  to  $2\frac{3}{4}$  inches, has been reached. The patients are warned not to apply excessive force, which is manifest by spotting, indicating injury of the delicate mucosa lining.

It is now time to use a tube 1.5 cm. ( $\frac{3}{8}$  inch) in diameter, inserted for the length of 7 cm. and kept in place every night for from 8 to 10 hours. When this tube is admitted readily, the final size 2 cm. ( $\frac{3}{4}$  inch) is used until marriage. In the earlier cases, still larger tubes were used but appear to be unnecessary. Examination of all these patients shows a normal vulva and introitus. The vagina readily admits two fingers to the depth of  $6\frac{1}{2}$  to 7 cm. ( $2\frac{1}{2}$  to  $2\frac{3}{4}$  inches) from the fourchette. The canal is lined with soft, resilient mucous membrane, and a standard vaginal speculum can be introduced and opened without discomfort to the patient.\*

\* Frank, R. T.: The formation of an artificial vagina without operation. *Am. J. Obst. & Gynec.* 35:1054, 1055.

### WHARTON OPERATION FOR CONSTRUCTION OF A VAGINA

In 1932 Wharton devised an operation based on the remarkable proliferative power of the vaginal mucosa. It is simple of execution and does not require the skill in plastic surgery necessary for the successful accomplishments of the older procedures then in vogue. Wharton described the operation as follows:

This is simplicity itself. A common feature in all operations for the construction of the vagina is the dissection of the space between the bladder and the rectum. This step in the operation can usually be finished easily in ten or fifteen minutes. Into this newly created space,

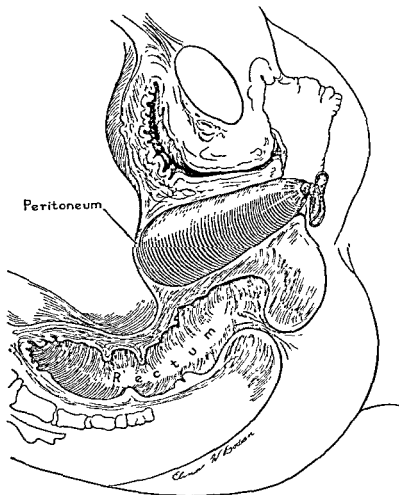


FIG. 401. Wharton operation for congenital absence of the vagina. Space has been completely dissected to the peritoneum. Rubber-covered balsa-wood mold is in place. In this instance skin-grafting was not used.

one introduces the vaginal mold covered by a condom, and that completes the operation.

The operative procedure is usually very easy. As Baldwin said, the creation of the space between the bladder and rectum can usually be done by blunt dissection, after the incision is made in the external mucous membrane or across the dome of the rudimentary vagina. One needs only to follow the plane of cleavage furnished by the fibro-areolar tissue between the layers of subvesical and perirectal fascia (Fig. 400). There is very little danger of perforating either the rectum or bladder, if one follows this layer. In case of doubt one can orient himself by a sound in the urethra or a finger in the rectum.

One can easily perforate the bladder, however, if this plane of cleavage has been replaced by scar tissue, due to a former operation. The author experienced this accident once.

There are two rather important details to observe in preparing the vaginal space. In the first place, the space must be larger than one expects it to be eventually. It may contract during convalescence; it is hardly likely to enlarge. The contracture may be due to slipping of the mold, to pressure of surrounding organs or to compression of the mold. The vaginal space should be large in all dimensions. The second item concerns hemostasis. One encounters significant blood vessels usually only at two points, at the level of the broad ligament on each side. These ligaments are rather resistant and may require incision in each lateral wall. At this point, the vaginal vessels leave the uterine arteries and veins and may require ligation. These vessels, however, are small and do not compare with the vessels found in the normal vaginal plexus.\*

The vaginal mold should be covered with two thicknesses of condom. Balsa wood, melted paraffin or a hollow tube wrapped with gauze may be used inside the condom. In placing it in the cavity one must be certain that it does not compress the urethra against the undersurface of the symphysis or make excessive pressure against the rectum (Fig. 401).

### McINDOE OPERATION

In 1938 McIndoe described an operation very much like that of Wharton with the additional step of skin grafting the newly formed vaginal cavity with a split-thickness skin graft, held in place with a vaginal mold.

\* Wharton, L. R.: A simple method of constructing a vagina, *Ann. Surg.* 107:843, 1938.

The operation has been done extensively in this country by Counseller with a high percentage of success. In the last 5 years we have used it exclusively with practically perfect results.

Before the operation is begun, it is important to distinguish between a congenitally absent vagina and uterus and an imperforate hymen. This can usually be done by pelvic examination. When the vagina and the uterus are congenitally absent, on rectal examination the urethra can easily be felt through the anterior rectal wall. This will be even more striking if a sound is placed in the urethra while the rectal examination is made. On the other hand, if one is dealing with an imperforate hymen with the vagina and the uterus present, a distended hematocolpos will be felt. In the rare cases in which the uterus is present but the vagina absent, the cervix and the uterus can be felt through the rectal wall. In such cases there is usually a very small space beneath the cervix, but it will not contain sufficient blood to form much of a mass. In those cases, there will be a history of recurring monthly pain as the patient attempts to force out the menstrual blood, most of which will be forced out of the tubes in a retrograde manner, causing peritoneal irritation.

### TECHNIC

First, a split-thickness skin graft is cut from the superiormedial aspect of the patient's thigh of proper size to cover the vaginal form (Fig. 402 A). Because of the resulting scar, a few patients have requested that the graft be taken from the buttock. The Reese dermatome is a convenient instrument for taking the graft, but an experienced graft-cutter can cut a satisfactory graft free-hand. The outer surface of the graft is dusted with sulfanilamide powder and placed between two layers of moist gauze. The thigh wound is then dressed with silver foil of petrolatum gauze and bound with a gauze roll. This wound is not dressed until the vaginal form is removed 2 weeks later.

The patient is placed in the lithotomy position, and an incision is made through the mucosa of the vaginal vestibule as shown in Figure 402 B. The space between the urethra

and the bladder anteriorly and the rectum posteriorly is then dissected until the under-surface of the peritoneum is reached (Fig. 402 B). This step may be made safer by inserting a sound or a catheter in the urethra.

Bleeders are clamped in the cavity and tied with very fine catgut. It is essential to have the cavity dry to prevent hemorrhage beneath the graft. Separation of the graft from its bed means the inevitable death of the

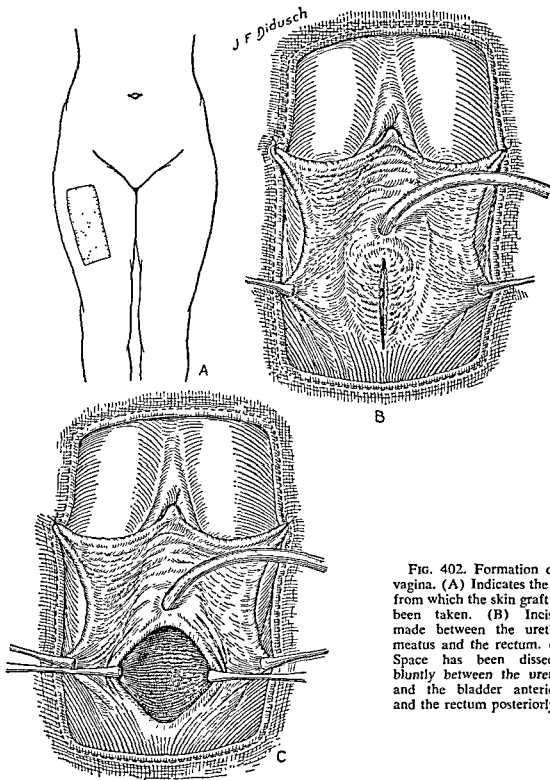


FIG. 402. Formation of a vagina. (A) Indicates the site from which the skin graft has been taken. (B) Incision made between the urethral meatus and the rectum. (C) Space has been dissected bluntly between the urethra and the bladder anteriorly and the rectum posteriorly.

graft in that area. A proper-sized balsa wood form covered with a double condom is selected by inserting various-sized forms into the cavity. When the proper-sized form is decided on, the condoms are removed; with the scalpel a bit of the balsa form is whittled away anteriorly to prevent pressure on the urethra. The condoms are replaced over the form and tied in place about the neck of a screw-eye in the end of the form. Recently we have used balsa forms covered with a thin layer of sponge rubber (Fig. 403) which in turn is encased in the condoms. Two or three of such forms should be made up be-

forehand to ensure having one of the proper size. Whether simple balsa or balsa covered with sponge rubber is used, one must be sure in fitting it that even pressure is exerted over the whole surface of the graft. The walls of the cavity must be smooth, clean and healthy to receive the graft. If the operation is a second attempt after a previous failure, one must meticulously cut away all bands of scar tissue which would prevent intimate application of the graft to a smooth surface.

The skin graft is then fitted over the form as shown in Figure 402 D. The outer surface of the skin, which has been powdered with

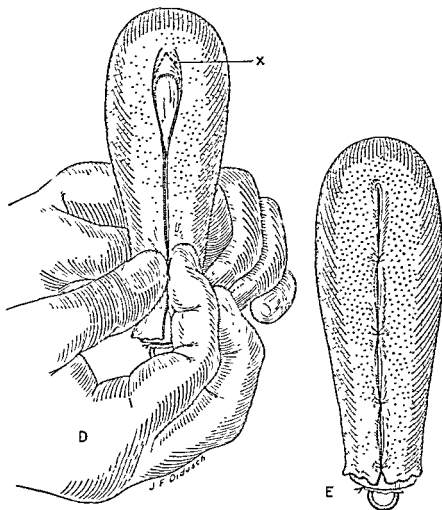


FIG. 402 (Continued). Formation of a vagina. (D) The form is covered with inverted skin graft. Note excision of excessive skin at X. (E) The edges of the graft have been sutured together to hold it in place over the form.

sulfanilamide, is placed next to the rubber. The powder prevents the graft from sticking to the rubber when the form is removed 2 weeks later. Using very fine chromic catgut, the graft is then sutured over the form (Fig. 402 E). The form is inserted into the cavity, and the edges of the graft are sutured to the mucosal edge at the vaginal incision (Fig. 402 F). If the labia minora are sufficiently

developed, they may be sutured together over the end of the plug with heavy silk to prevent it from coming out (Fig. 404). If this is not feasible, the plug may be held in place by thin rubber tubing such as is used to cover cigarette drains. The method by which this is attached to the patient is shown in Figure 402 G.

A Foley catheter is placed in the bladder,

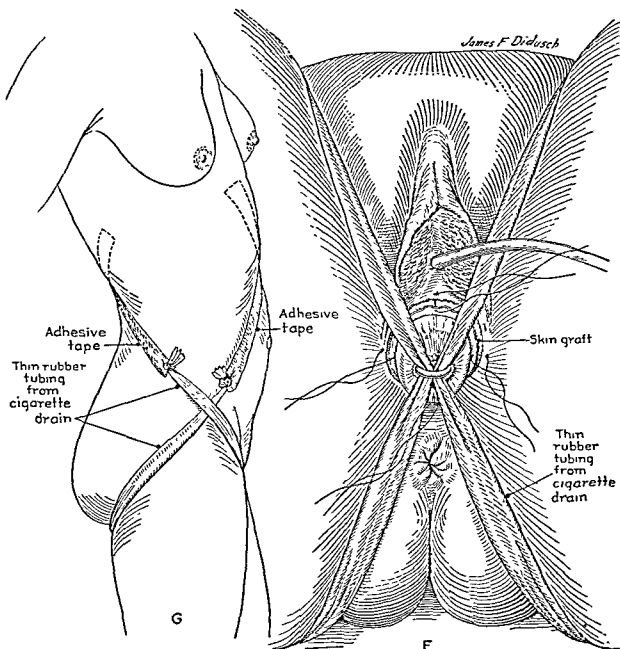


FIG. 402 (Continued). Formation of a vagina. (F, G) Demonstrating method of holding the form in the vagina when the labia cannot be sutured together to hold it.

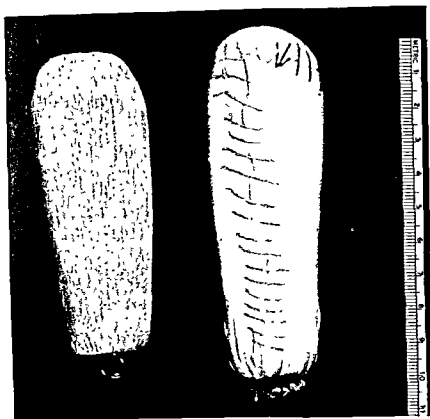


FIG. 403. Balsa vaginal form. The form on the right has been enclosed with a thin coat of foam rubber, making for ideal pressure of the skin graft on its bed

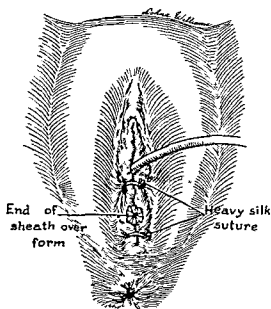


FIG. 404. Demonstrating closure of labia with heavy silk to retain the form.

and a sterile split cotton pad is placed over the vaginal outlet. The pad is split so as to fit over the catheter and is removed at defecation.

The form is left in place for 2 weeks, and also the catheter is left in the bladder. At the end of that time the form and the catheter are removed under light Pentothal Sodium anesthesia. The vaginal cavity is irrigated with warm salt solution and is inspected. In all of our cases we were pleased with the perfect "take" of the skin graft. The patient is instructed as to removal of the form and is advised to do so at urination and defecation. She is sent home with instructions to continue to wear the form for approximately 6 months. If she then gets married she can discontinue wearing it unless she notices a tendency for the vagina to contract. If she does not get married within that time, she is advised to continue wearing the form at night. She is also advised to take a douche 2 or 3 times a week.



## COMPLICATIONS AND RESULTS

The functional result is more important than the anatomic result in evaluating the success of the operation. A vagina of only 4 cm. in an instance was considered very successful by both husband and wife. At the time of this writing we have done the McIndoe operation on 32 patients, follow-up having been possible in 29. In 22, there were no complications. In 7 there were complications. In one it was necessary to remove the form on the 4th postoperative day because of bleeding. The vault contracted but subsequently was lengthened satisfactorily. In 3 patients small rectovaginal fistulas developed, one of which healed spontaneously; 2 others were easily corrected surgically, leaving good functioning vaginas. In 2 cases there was sloughing of the distal portion of the urethra, but this did not interfere with urinary continence. This has not occurred in any of the recent cases in which the anterior portion of the form is cut away. One patient discovered on her honeymoon that the caliber of the vagina was too large and a subsequent perineal repair made the vagina "perfect," according to her statement. In a few cases the "take" of the graft was not perfect, but on keeping the granulation tissue burned down with a silver nitrate stick, epithelialization became complete.

## PARTIAL ABSENCE OF THE VAGINA

Partial absence of the vagina is much less common than complete absence. Figure 405 shows diagrammatically the pelvic organs of a woman who congenitally had a vagina of about three fifths normal length. She had had difficulty at the beginning of her menstrual life with severe menstrual pain, but no external bleeding. Finally, she began to flow externally through a small sinus shown in Figure 406 A. Pelvic examination per rectum revealed a cervix and a normal-sized corpus. The ovaries were palpable, but adherent, probably due to organized blood from hematosalpinx and hematoepitrium. The remarkable thing was that she had very little dysmenorrhea after beginning to menstruate externally. Coitus was fairly satisfactory, but

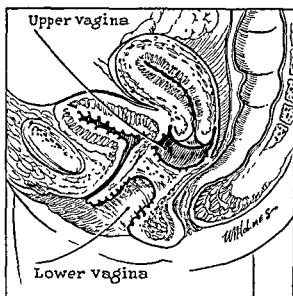


FIG. 405. Partial absence of the vagina, for which operation shown in Figure 406 was done.

the shortness of the vagina was somewhat of a handicap.

**Technic of Operation for Formation of a Complete Vagina for Condition Shown in Figure 405.** A transverse incision was made through the vault of the short vagina, connecting the opening of the sinus tract with the dimple on the opposite side (Fig. 406 A). A probe could be introduced into the sinus tract for about 2 cm., but there was no induration along the tract, and only pliable areolar tissue was encountered in dissecting the space between the vagina and the rectum. After continuing this dissection for about 3 cm. the cervix could be palpated, but it was apparently covered with a membrane, the under surface of which was visible (Fig. 406 B). It was obvious that this membrane had to be opened in order to expose the cervix. The danger of opening the bladder and the rectum was recognized. With a mushroom catheter in the bladder which could be moved about, the limits of the bladder could be recognized. An assistant inserted his gloved finger beneath the drapes into the rectum so that the anterior rectal wall could be recognized at all times. An incision was then made through the mucosa, just posterior to the cervix as shown in Figure 406 B. The small upper vaginal cavity

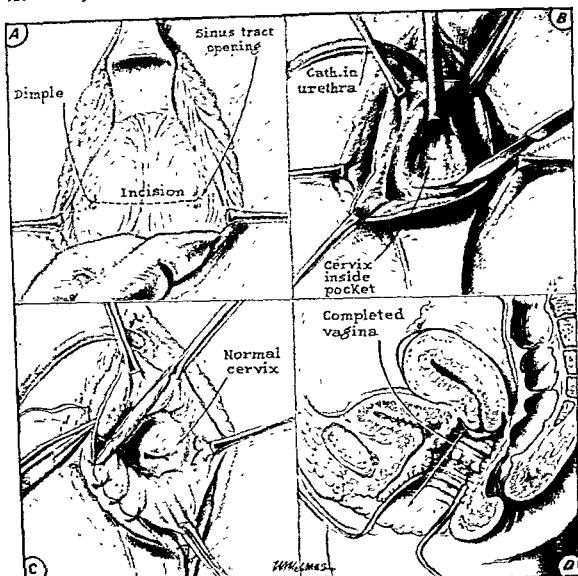


FIG. 406. (A) Showing upper end of a short vagina, with sinus tract opening through which the patient menstruated; also showing incision through mucous membrane. (B) Areolar tissue has been dissected through to the pocket of mucosa which covered the cervix. The mucosa is being incised. (C) An anastomosis is being made between the lower vagina and the upper vagina. (D) Showing completed vagina. It is slightly shorter than normal but of normal caliber.

was thus entered, and the cervix was exposed. The opening in the upper vagina was enlarged until it equalled the opening in the vault of the lower vagina. The edges of the upper and the lower cavities were then anastomosed, using interrupted sutures of No. 00 chromic catgut (Fig. 406 C). Figure 406 D shows the completed anastomosis with a

vagina which is of normal caliber but slightly shorter than the normal average.

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# Surgical Conditions of the Vulva

## FIBROMA AND FIBROMYOMA OF THE VULVA

Fibroma and fibromyoma of the vulva are rare but occur more frequently than any other benign tumors of this region (Fig. 407). There are three sources of origin: the fibrous tissue of the vulva, the extraperitoneal portion of the round ligament and the intrapelvic connective tissue. The tumors arising from the connective tissue of the vulva are apt to be fibromas, and hyaline degeneration is common in them. The tumors arising from the round ligament contain more smooth muscle and usually feel firmer. Those arising from the intrapelvic connective tissue present at the vulva as the growth extends downward have been known to reach enormous size.

Symptoms arise as a result of the size and the weight of these tumors. The patient may complain of difficulty in walking, sitting, coitus and urination. Over a fifth of those reported by Leonard from our laboratory were said to have undergone sarcomatous degeneration, but our more recent experience does not bear out such a high percentage of malignant change.

The treatment is surgical excision. Figure 408 A shows a typical large fibroma, arising from the right labium majus. It was connected by a very large pedicle, which encroached on the base of the right labium minus, so that the removal of the labium with the tumor was necessary. The large defect shown in Figure 408 B was closed with interrupted sutures of No. 00 chromic catgut, and the skin incision was closed with a lock stitch of fine silk (Fig. 408 C).

## LIPOMA OF THE VULVA

In spite of the fact that the labia majora are composed chiefly of fat, lipoma of the

vulva is very rare. Lipomatous tumors are sessile when small, but because of their position they may become pedunculated when they reach considerable size. The soft consistency of the fat frequently suggests that they are cystic, and the possibility of hernia must be considered. As in lipomata elsewhere, the lobulation gives one the cue as to their real nature. The smaller lipomata are quite asymptomatic. When they become larger they may interfere with walking, sitting, coitus or urination. A few enormous vulval lipomas have been reported in the literature—the largest by Lovelace, who reported a 44-pound tumor that extended as far as the patient's knees.

The treatment of lipoma of the vulva is excision. Small sessile tumors are easily enucleated. When large tumors are attached by small pedicles, excision may also be simple, but large tumors that are sessile or attached by large pedicles may present surgical problems of considerable difficulty. The electrosurgical knife is a great aid and saves much operating time. Figure 409 A shows a rather large lipoma, arising at the base of the left labium minus and growing inward to displace the urethra to the right. The problem was to remove the tumor without injuring the urethra. A glass catheter in the urethra made it palpable at all times. The dotted line in Figure 409 A shows the incision through the stretched mucosa, made so as to remove some of the mucosa with the tumor. The lipoma was enucleated by sharp and blunt dissection, and the dead space was obliterated with mattress sutures of fine chromic catgut (Fig. 409 B). Finally, further excessive mucosa was excised, and the wound was closed with a continuous submucosal stitch of fine catgut (Fig. 409 C and D).

# HIDRADENOMA (SWEAT-GLAND TUMOR) OF THE VULVA

This rare benign tumor of the vulva was first described by Schickele in 1902. Approximately 100 have been reported in the American literature. It is of importance to the gynecologic surgeon because it is often

mistakenly diagnosed as malignant and treated unnecessarily radically. The possibility of error in microscopic diagnosis is understandable, since the adenomatous pattern of the growth may have a proliferative appearance; if the pathologist lacks definite clinical follow-up knowledge of such cases,

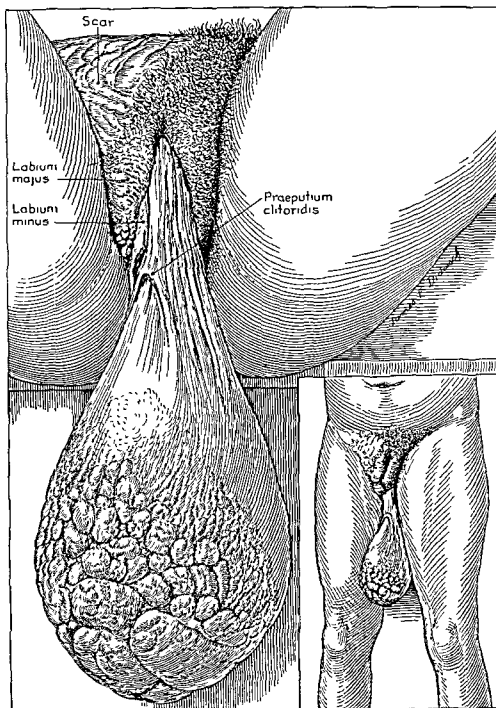


FIG. 407. Large fibroma of the vulva.

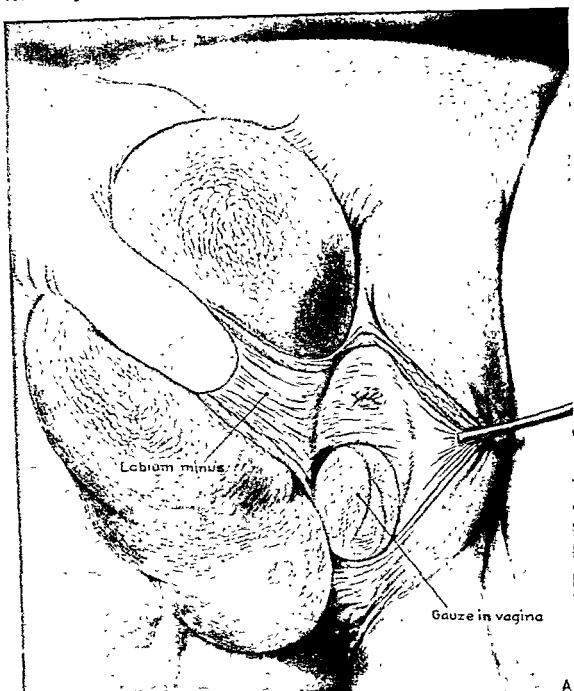


FIG. 408. Partial vulvectomy for benign lesion. (A) A large fibroma arising from the right labium majus, to be removed by partial vulvectomy.

he might easily consider the tumor as malignant.

Novak and Stevenson have carefully studied 14 hidradenomas from our laboratory. They have noted considerable variation

in the microscopic picture. The usual pattern is of the adenomatous type, with the glands closely packed and varying greatly in size (Fig. 410). The epithelial lining of the glands may be single, but in many tumors

the glands are lined by an inner layer of short columnar or cuboidal cells, and beneath this layer is another layer of cells, closely packed with small dark nuclei. In many of the tumors there is a great tendency to epithelial proliferation, and the gland lumina are filled with epithelial plaques, similar to those found in the cervix, due to epidermidization. Obviously, tumors of this type may be considered as malignant if the pathologist is without clinical knowledge of the course of the disease.

The practical question from the point of view of the operating gynecologist is whether or not the lesion is malignant, and a consideration of the evidence is worth while. Novak and Stevenson have made a critical review of the cases found in the literature, many of which were reported as malignant. It is obvious that most of the cases which have been considered malignant have been judged purely on histologic grounds. In fact, in only one case did Novak and Stevenson conclude that there was indisputable evidence

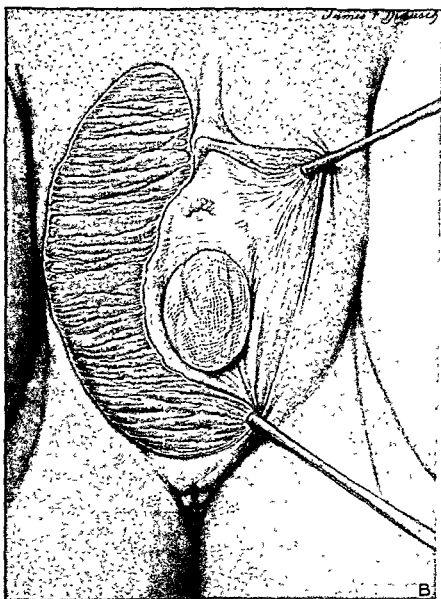


FIG. 408 (Continued). Partial vulvectomy for benign lesion. (B) Partial vulvectomy has been performed, leaving fatty base.

of adenocarcinoma. In that case the left labium majus, on which the tumor grew, was widely excised, together with the left inguinal glands. The glands showed definite metastases, but the patient was well 2 years after the operation. However, in considering the question of malignancy of these tumors, it is only fair to say that occasionally adenocarcinoma of the vulva is encountered

in which it is quite impossible to ascertain the origin, and a sweat-gland origin is possible but not certain. There were 2 such tumors in our laboratory described by Novak and Stevenson in connection with 14 undoubtedly benign hidradenomas.

Clinically, the tumors are small, usually not over a centimeter in diameter (Fig. 411). They are sessile and are covered with nor-

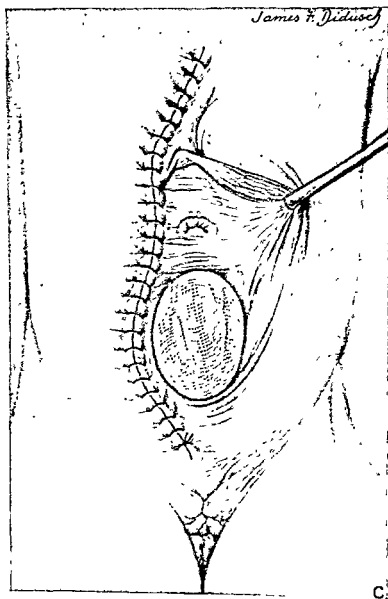


FIG. 403 (Continued). Partial vulvectomy for benign lesion. (C) The subcuticular fat has been approximated with interrupted sutures of fine catgut. The skin is closed with a continuous suture of fine silk.



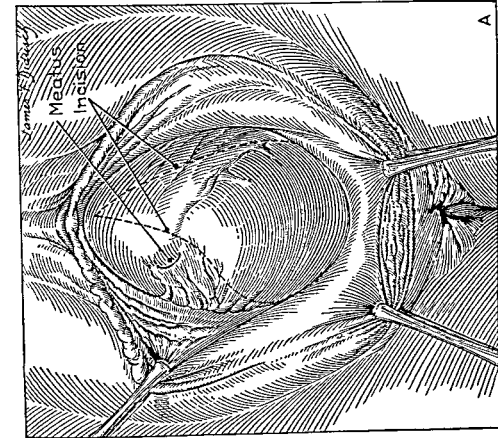


FIG. 409. Excision of large lipoma of the vulva. (A) An incision is made as indicated by the dotted line, care being taken to avoid the urethral meatus.

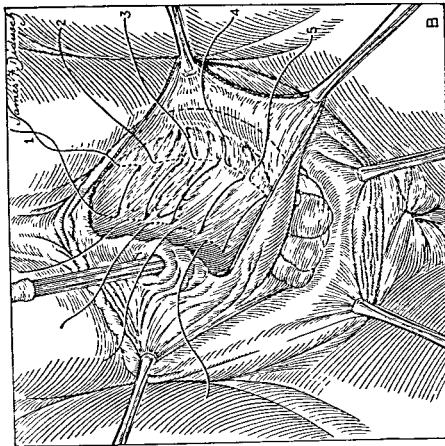


FIG. 409 (Continued). Excision of large lipoma of vulva. (B) The tumor having been removed by blunt and sharp dissection, the cavity is being closed by a layer of interrupted mattress sutures of fine catgut. A glass catheter is kept in the urethra during the operation for easy identification at all times.

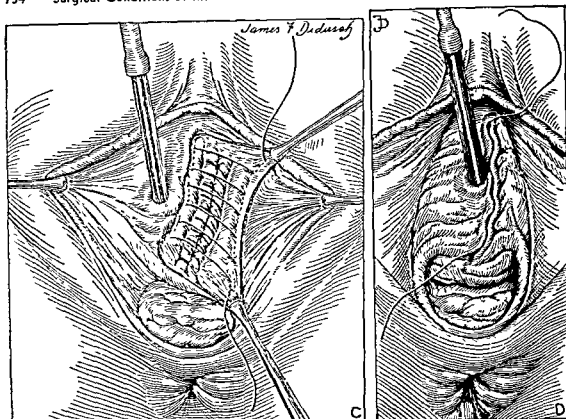


FIG. 409 (Continued). Excision of large lipoma of vulva. (C) Mucosa approximated with a continuous submucosal suture. (D) Completed operation. Submucosal suture is made taut and cut long without tying.

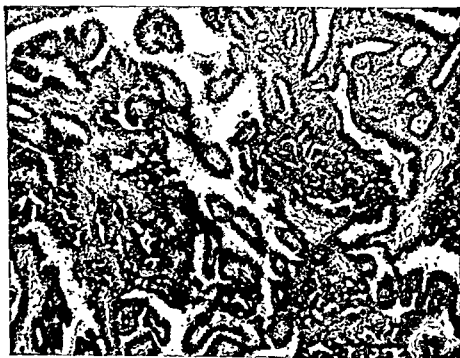


FIG. 410. Low-power magnification section of hidradenoma of the vulva.

mal skin. Their consistency may be firm or as soft as a sebaceous cyst, with which they are often confused. The majority are found on the labia majora, but they also occur on the perineum, the labia minora, the vaginal vestibule and on the perilabial skin. A small superficial granular area is often seen on the surface, and in some instances reddish-brown pulpy exudate may be expressed. There is no discomfort from the growth, and many hidradenomas are discovered incidentally on routine pelvic examination.

The treatment consists of complete local excision. Recurrences have been noted from incomplete excision, but excision of the local recurrences has resulted in cure. The important thing is to have the excised tumor examined by a competent gynecologic pathologist so that its true nature is recognized, thus avoiding an unnecessary mutilating operation.

### PAPILLOMATA OF THE VULVA

Papillomata of the vulva are of two types. The ordinary papilloma of the skin may occur on the labia majora or the mons veneris. It is covered with normal-looking skin, is usually attached by a small pedicle and does not become ulcerated.

Condylomata acuminata represent the other type. They characteristically occur on the vulva, the perianal skin and sometimes in the vagina. They have been designated as venereal warts, but actually they are not a venereal disease. It is true that they are often present in women with chronic gonorrheal cervicitis, but any vaginal discharge favors their growth. However, we have seen them in women with no abnormal vaginal discharge, in whom there is no suggestion of previous neisserian infection, who are very clean in their habits. Nonetheless, there is no doubt that excessive moisture favors their growth. They vary in size from small excrescences of 1 or 2 millimeters in diameter to massive conglomerations of papillomata as large as a cauliflower (Fig. 412).

Histologically, condylomata acuminata differ from the ordinary papillomata. The latter are covered with normal-appearing epithelium over a treelike connective-tissue core. Condylomata acuminata are covered with markedly hypertrophied, stratified squa-



Fig. 411. Hidradenoma of the vulva.

mous epithelium, with marked cornification. There is always a marked infiltration of the epithelium and subjacent connective tissue with lymphocytes, plasma cells and polymorphonuclear leukocytes.

The treatment of the smaller lesions is very simple. Each may be completely destroyed by fulguration. The massive growths may require excision with the electrosurgical knife. They should not be excised during pregnancy, when they often grow rapidly. Spontaneous regression, and even disappearance, often occurs after pregnancy, and the increased vascularity during pregnancy makes the excision of massive condylomata dangerous. Massive growths may necessitate delivery by cesarean section. To prevent recurrence of the condylomata, vaginal discharge, if present, should be cleared up.

In 1942 Wolters and Hesseltine reported 11 cases successfully treated by irradiation. We have had no personal experience with

this form of therapy, but their report would indicate that it is worthy of a trial. They used radium in 50 mg. quantity, contained in 0.5 mm. Pt capsules, filtered through 1 mm. Al. The optimal dosage, according

to these authors, is approximately 100 mg. hr. to an area of about 4 sq. cm.

### CYSTS OF THE VULVA

*Cysts of Bartholin's glands are common,*

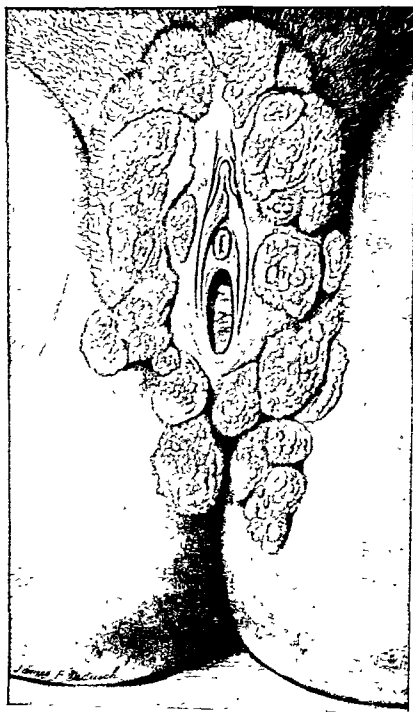


FIG. 412. Multiple large condylomata acuminata.

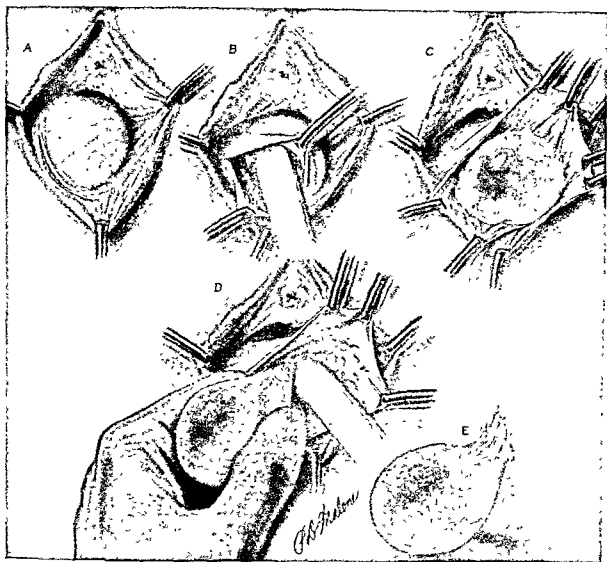


FIG. 413. Excision of Bartholin's-gland cyst. (A) An incision is made in the mucosa over the cyst. (B) Dissection is begun, using the handle of the scalpel. (C) Dissection has been continued by sharp and blunt dissection. (D) Dissection is almost complete. (E) Shows intact cyst after removal.

and by far the commonest cysts occurring in the vulval region. They are non-neoplastic and result from retention of glandular secretions due to blockage somewhere in the duct system. The commonest cause of this obstruction is gonococcal infection. However, such obstruction does occur rarely in virginal women and occasionally in parous women who never have had a neisserian infection. It is probable that the Bartholin's duct may become obstructed by the healing of obstetric tears or abrasions. The contents of most of the cysts are clear mucoid material, but hemorrhage may occur in them and darken the

fluid. More commonly the cyst contents become secondarily infected, usually with the colon bacillus, forming a pseudoabscess with an epithelial-lined wall, with many or few layers, depending on the part of the duct that forms the cyst. If the cyst wall is formed by a terminal duct or acinus, the lining is of cuboidal epithelium. If the wall is lined by epithelium of the duct system nearer the surface, it is of the transitional or squamous type. The epithelium may be flattened by pressure or even entirely destroyed.

Most small Bartholin's cysts are incidental findings at routine pelvic examinations. They

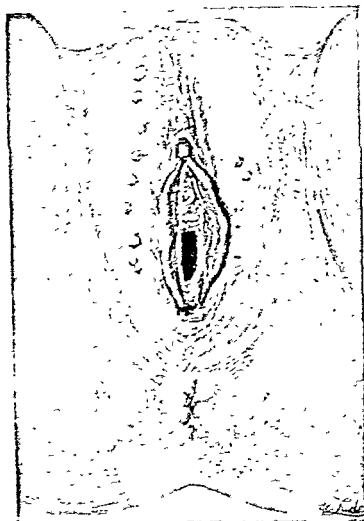


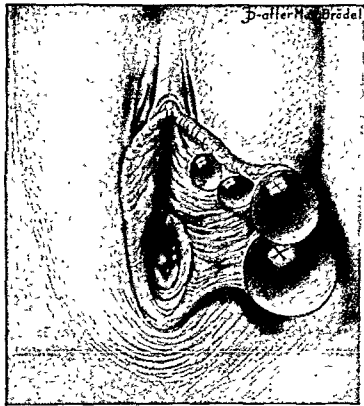
FIG. 414. Showing multiple sebaceous cysts on labia majora.

are quite asymptomatic, unless infected. The larger cysts may also give rise to no symptoms, even when they have attained considerable size. Discomfort at coitus, sitting or walking is the usual complaint when the cyst does become symptomatic.

If an opening is accidentally made through the mucosa, a buttonholelike opening is apt to persist. If, on the other hand, the incision is made on the mucosal side, usually no difficulty is encountered in dissecting the cyst from the inner surface of the skin.

Since cyst formation is usually preceded by inflammation, the cyst wall is adherent and cannot be shelled out easily with blunt dissection. The blunt-pointed Mayo scissors serve admirably for sharp dissection of the cyst wall from its bed (Fig. 413 B, C and D). Often when the cyst is large, it will have developed posteriorly, close to the rectum. This should be borne in mind in dissecting the cyst free. If danger seems to be imminent, the assistant may insert his finger in the rectum, but this is rarely necessary. Complete removal of the gland tissue, ad-

FIG. 415. Cysts of labium minor.



herent to the cyst wall, is essential, for if some is left the residual glandular tissue may form another cyst. In making the dissection, the noncystic portion of the gland usually can be detected easily by palpation. It feels quite indurated in contrast with the surrounding soft tissues. Curtis recommends deliberate opening of the cyst and dissecting the wall from the surrounding tissue. At times, this procedure is extremely convenient.

If an infected cyst is ruptured at operation, the operative field may be dusted with sulfanilamide powder and closed tightly without drainage.

There is usually troublesome bleeding in carrying out the dissection. The bleeders must be clamped and tied with fine catgut or coagulated with the diathermy current. Finally, to ensure permanent hemostasis the entire cavity must be obliterated by approximating the walls with fine chromic catgut. The final approximation of the mucosa is accomplished best by a continuous submucosal suture of zero chromic catgut.

If the cyst is large, the patient is kept in bed for a week. If the wound breaks down, sitz baths are ordered until it is healed.

Sebaceous cysts are also common, but

they do not often cause symptoms unless they become infected. Small cysts, 3 to 5 mm. in diameter, are common; they constitute incidental findings on routine pelvic examination. They rarely reach a diameter of 1 cm., but Figure 414 shows an unusual collection of large cysts on the labia majora. When uninfected, they are usually entirely asymptomatic, or else the patient may have noticed a small nodule for which she wishes an explanation. Usually they are brought to the patient's attention when they become infected and tender. They occur most often on the labia and especially on the inner surfaces. The yellowish color imparted to them by their sebaceous contents makes them readily recognizable. The cysts rarely become large enough to require removal. More commonly, the smaller ones require incision when infected. Hot compresses of salt solution or sitz baths, following incision, usually give the patient comfort promptly. They very seldom require removal after incision.

Cysts arising from the terminal portions of the wolffian ducts occasionally occur in the region of the hymen, the clitoris or the labia minora. They are usually thin-walled and translucent (Fig. 415). Since they arise

near the junction of the wolffian duct and the skin, they may be lined with columnar or stratified squamous epithelium or a combination of both. They are always benign, and excision is required only if they annoy the patient, but such occasions occur only infrequently.

### GRANULOMA INGUINALE

Granuloma inguinale is a chronic venereal disease, transmitted usually by sexual contact and characterized by ulcerative and granulomatous lesions of the genitalia and the adjacent regions. McLeod, of India, first described the disease in 1882, but it was described more completely by Conyers and Daniels in 1896. It is limited almost entirely to Negroes, but a few authentic cases have been reported in the white race. It is commonest in people of unclean habits and of sexual promiscuity. There are a few cases of probable nonsexual transmission reported in which the face and the neck are involved.

The early lesion, which occurs on or near the genitalia, is a small elevated papule, which very soon becomes ulcerated. The ulceration may attain enormous size. It involves the skin and the subcutaneous tissues and appears like exuberant granulation tissue with a slightly elevated overhanging epithelial edge. Secondary infection of the granulating surface is inevitable. A fusiform bacillus and spirochete are commonly found, but these organisms have no relation to the disease etiologically. Spontaneous healing of the ulcerations is rare, but there may be remissions with partial epithelialization. Inguinal-gland enlargement is common, suggesting the possibility of spread by lymphatics, as well as on the skin surface. Fibrosis may result in lymph stasis, the disease being one of the causes of chronic hypertrophic vulvitis. In addition to the vulva, the groin, the thighs and the vagina are commonly involved. Pund and MacInnis reported 24 proved cases of cervical involvement, 6 of which were fatal; Arnell and Potekin reported another series of 38 cervical cases, 4 of which were in white women. Pund and Gatcher have reported 1 case of granuloma inguinale of the uterus, the tubes and the ovaries. The involvement of distant parts of the body has been described. Among such

cases are 3 that occurred on our service, which were reported by Lyford and Scott. In all 3 there was genital ulceration, associated with polyarthritis and osteomyelitis. Donovan bodies were found in tissue removed from bone in 2 of the cases, and in the purulent discharge from a sinus communicating with the bone in the other. It seemed almost certain that dissemination must have occurred via the blood stream.

The finding of Donovan bodies within large monocytes in the tissues or on smear from the surface of the ulceration proves the diagnosis. The Donovan bodies can usually be seen when stained with the ordinary hematoxylin and eosin stain, but Dieterles' silver stain is more satisfactory.

Aragao and Vianna, Walker, Randall, Small and Belk cultivated gram-negative encapsulated bacilli, belonging to the Friedländer group, from the surface of the ulcerations, but Dienst, Greenblatt and Sanderson concluded on seemingly good grounds that these organisms were contaminants. They inoculated a Negro subcutaneously with 5 cc. of exudate full of Donovan bodies. In 3 weeks a small swelling, about 5 mm. in diameter, was noticed at the site of inoculation. In 5 weeks the swelling had increased to 30 mm. in diameter. Aspirated exudate from this swelling was rich in Donovan bodies, but no bacteria could be grown. Since the Friedländer bacillus is easily grown, it seemed unlikely that this organism could have been responsible for the lesion. Donovan bodies are apparently not pathogenic for small laboratory animals, nor have they been cultured by ordinary methods. However, Gey, working with Lyford and Scott, was able to grow Donovan bodies for several weeks in tissue culture of material obtained from bones and joints.

The chief symptoms of granuloma inguinale, occurring in the vulva and the inguinale regions, are pain and bloody discharge. When hypertrophic vulvitis occurs, it may interfere with locomotion, sitting and coitus. The patient pictured in Figure 416 was scarcely able to walk as a result of the extensive ulceration and scarring. Defecation and urination were extremely disagreeable through the mass of granulation tissue.

The treatment of granuloma inguinale is



difficult and requires persistence on the part of both patient and physician. However, these patients are so miserable that great persistence is justified. Results are only moderately successful, but often much can be accomplished by the intelligent combination of drug therapy and surgery. Conyers and Daniels first attempted surgery, but the results were unsatisfactory in many cases. Then Aragao and Vianna, in 1913, found that tartar emetic (antimony and potassium tartrate) gave satisfactory results in a certain percentage of cases. However, relapses were common. In 1933, Williamson and his co-workers reported that a new antimony compound, sodium antimony-iii biscatechal disulphonate of sodium, known commercially as "Fuadin," cured some cases that had resisted tartar emetic treatment. Sulfonamides have proved to be disappointing in the treatment of the condition, and recently Nelson found that large doses of penicillin failed to alter the course of the disease.

Robinson has recently reported his results with antimony compounds and surgery. He used freshly prepared 1 per cent solution of tartar emetic intravenously, beginning with 3 cc. given 3 times a week, and increasing 1 cc. each week until the patient's tolerance is established. He also treated patients with stock ampule dosage of Fuadin and Anthiomaline, intramuscularly, and antimony sodium thioglycollate, intravenously. Of 46 patients whose treatment was completed, 19 were cured by tartar emetic, 9 by other antimony compounds; of these, 5 had already received tartar emetic; therefore, 60.8 per cent were cured by antimony compounds. In 10 patients in whom chemotherapy failed, operative procedures were successful in causing a cure, 9 by excision and 1 by desiccation. When excision is practiced, it should be done electrosurgically, excising the ulcer with a generous margin of normal skin, if possible.

#### LYMPHOGRANULOMA VENEREUM

Lymphogranuloma venereum has become the accepted name of a venereal disease to which many other names have been applied. Among these are: lymphopathia venereum, lymphogranuloma inguinale, subacute inguinal lymphogranulomatosis and climatic

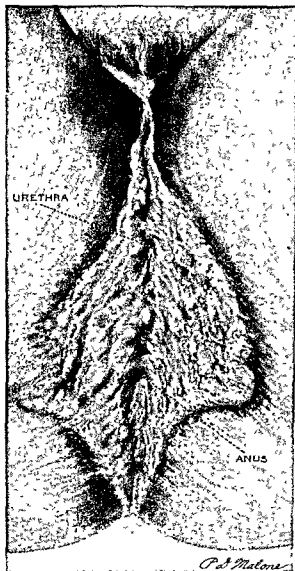


FIG. 416. Granuloma inguinale, a recurrence following vulvectomy.

bubo. Without doubt, many of the cases described in the earlier literature as esthiomene and anorectal syphiloma were lymphogranuloma venereum. The disease is venereal in origin, and reports from various parts of the world indicate its global distribution. Its filtrable virus etiology has been established, and infection in laboratory animals has been accomplished. It occurs in both the white and the colored races but is much more frequent in the latter. Schulte and Lubitz, for example, reported 33 cases, 29 of which were in Negroes and 4 in whites. Our modern knowledge of the disease dates from 1913 when Durand, Nicolas and Favre published

the results of their 8-year study. They introduced the name "lymphogranuloma inguinale" because of an apparent histologic resemblance of the involved glands to Hodgkin's disease.

The primary lesion is inconspicuous and often is overlooked, particularly in the female. There is, in fact, considerable controversy as to what constitutes the primary lesion. One sees an occasional small ulcer about the fourchette in women which may represent the primary point of invasion. Gray and Barnes believe that a pinkish-red puffy urethral meatus may also be the primary lesion. The infected spreads along the lymphatics, and after a few weeks the secondary manifestations appear. These are quite different in the male than in the female. Inguinal adenitis appears as the major lesion in the male, whereas only a small proportion of the females develops significant adenitis. The adenitis is painful, and peradenitis develops, causing fusion of the glands into a tender mass. Small abscesses form in the glands and break down, resulting in multiple sinuses. Presumably, the primary lesions that occur anteriorly on the vulva develop into adenitis. There are more primary lesions in the region of the fourchette, and the drainage from these is toward the rectum through the rich lymphatics which communicate between the vagina and the rectum. The perianal and the perirectal regions become involved, and the process extends to the anus and the rectum, sometimes up high enough to involve the sigmoid. The rectal wall becomes edematous, fibrotic and ulcerated, finally resulting in a dense tubular stricture in many cases. Edematous fibrotic tags may protrude from the anus. As the lymph drainage from the vulval region is interfered with, part or all of the vulva becomes enlarged with chronic edema and fibrosis, giving rise, in some cases, to the typical chronic hypertrophic vulvitis.

Of special interest are the cases in which ulceration and destruction of the female urethra have taken place. We have seen many instances in which the entire urethra has been destroyed, resulting in complete incontinence. We have observed a rare case in which the urethral fibrosis has resulted in stricture and acute retention. The ulceration

is often self-limited, and in some of the cases presenting themselves with urinary incontinence the active lesion appears to have healed completely. Remarkable as it may seem, some of these patients give no history of discomfort to suggest a previous urethral ulceration.

We never have seen the lesion of lymphogranuloma venereum extend high enough up the vagina to involve the cervix. The question of tubal involvement never has been settled. The broad ligaments are often thickened, and we commonly have seen salpingitis associated with the vulval disease. Such tubes are usually sterile to ordinary culture, but it has seemed more likely that such tubes are the result of a coincidental neisserian infection than of this virus disease. More investigative work should be done to settle this important point.

Clinically, there is no doubt that some of the minor ulcerations are entirely symptomatic and escape the patient's notice. At the other extreme one sees some of the most miserable of human wrecks. Enlargement of the vulva and fibrotic contractures may interfere with walking, sitting and coitus. Constipation, incontinence and a mucoid, bloody discharge from the anus are common. Anemia, weakness, fever, anorexia, nausea, loss of weight and prostration eventually occur in the advanced cases, and the patients look and feel as ill as those with advanced malignancy.

In 1925 Frei described an intradermal test, using as antigen bacteriologically sterile pus removed from buboes. Although many writers indicate that this test is quite specific, one cannot refrain from noticing that the test falls short of an ideal specific test. The results of Robinson, working in the venereal clinic at Johns Hopkins Hospital, indicate the shortcomings of the test. He used antigen which he prepared by diluting pus aspirated from fluctuant but unruptured buboes. He considered as positive an intradermal nodule 0.5 to 1 cm. in diameter with surrounding erythema, varying in size from 1 to 4 cm., but without central vesiculation or necrosis. He considered as strongly positive an intradermal nodule with central vesiculation followed by ulceration and necrosis, the area of surrounding erythema often

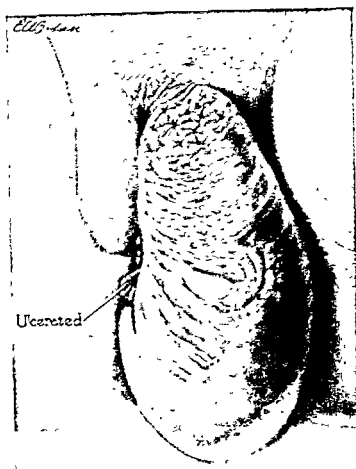


FIG. 417. Chronic hypertrophic vulvitis, resulting from lymphopathia venereum.

edema of the vulva (Fig. 417). In the older literature this clinical picture is reported under a variety of names, such as esthiomene, syphiloma, rodent ulcer and lupus. The objection to these terms is that they assume a specific etiology that is not proved. More recently, the same clinical picture of "elephantiasis" has been seen in association with vulval lesions of granuloma inguinale and lymphogranuloma venereum. In our present incomplete knowledge of the above-mentioned conditions, it is convenient to recognize this clinical picture of chronic hypertrophic vulvitis. In doing this, we realize that we may be dealing with lymphangitis and chronic lymph stasis of several different etiologies. Ulceration of some degree is the rule, and it is possible that the secondary infection, which invades the tissues through the ulcerated area, is responsible for much of the fibrosis and lymph stasis.

Some factors in the etiology are definitely established and deserve consideration. There is a great predisposition on the part of the colored race to the disease, as there is a predisposition on the part of this race to keloids and fibroids. A few isolated cases have been reported in the white race, but all of the cases on our service have occurred in Negroes. Uncleanliness seems to predispose to its development, and a chronic vaginal discharge is the rule. In a high percentage of the cases there is a positive serologic test for syphilis. Taussig estimates this as between 80 and 90 per cent. Our experience confirms this, and it would seem far too high a percentage to be a coincidence. Taussig believes that the ulcerations originate on the bases of syphilitic scars, and the spirochete is less a direct cause of the edema and the fibroses than are the secondary pyogenic organisms.

Histologic examination of biopsied tissue gives no clue as to the exact etiology unless Donovan bodies are found. The granulation tissue of the ulcerated area is heavily infiltrated with lymphocytes, plasma cells and polymorphonuclear leukocytes. The non-ulcerated area is covered with thickened epithelium which may dip down into the sub-jacent tissue. Portions of the epithelium may be pinched off by the fibrous tissue lying beneath the surface and simulating invasion. The mass of connective tissue, which forms the bulk of the tumor, is edematous and infiltrated with inflammatory cells. Plasma cells are particularly plentiful, and in some cases giant cells are present. Usually they are not

surrounded by epithelioid cells, and one is not justified in a diagnosis of tuberculosis on the presence of giant cells alone. We never have been able to stain tubercle bacilli in the tissues.

When the hypertrophy is slight, there may be insufficient symptoms to call the patient's attention to the lesion. The cases that seek medical aid do so after there is sufficient labial enlargement to cause difficulty in walking or in urination. Examination may show uniform enlargement of the vulva, or the enlargement may be limited to one or more of the labia. The skin appears coarse and thickened, simulating elephant hide. Ulcerated areas may be small and hidden between

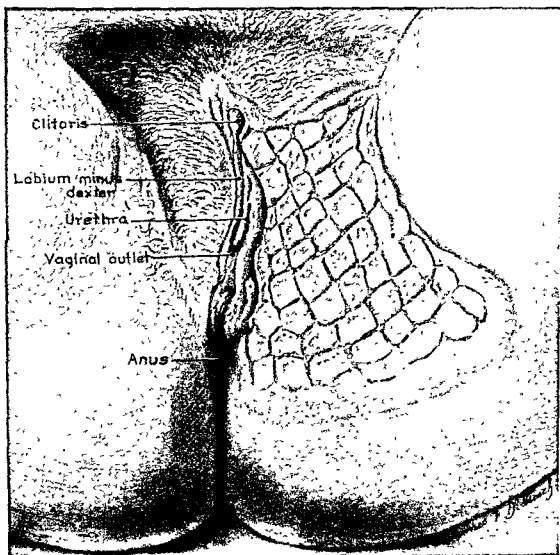


FIG. 418. Skin grafts following radical excision of lymphopathic tissue.

the folds, or ulceration may be extensive. Biopsy of the ulcer may be required to rule out malignancy.

The treatment is surgical. If granuloma inguinale is proved or suspected, tartar emetic and/or Fuadin should be given in full dosage. Following this, there may be some healing of the ulceration, but this is seldom complete. If the serologic tests for syphilis are positive, antiluetic treatment should be carried out. Here, again, there may result some healing of the ulcer, but there will be no change in the hypertrophied labia.

Vulvectomy, partial or complete, depending on the extent of the lesion, is the only effective treatment. If the lesion is not too extensive, so that all of the diseased tissue can be removed with a margin of normal tissue, healing is complete, and the results are quite satisfactory. Wide excision beyond the degree of possible closure of the wound may be necessary in some cases, with later skin grafting. Figure 418 shows such a case after extensive unilateral vulvectomy. The cases in which the brawny induration extends up into the vagina present a difficult surgical problem, and often some diseased tissue must be left. However, even though the operation is incomplete, the removal of the great mass of hypertrophied vulva gives the patient considerable relief.

### KRAUROSIS OF THE VULVA

The term "kraurosis" was first used by Breisky in 1885. Since then it has been employed loosely and indefinitely in the literature, and one is left in utter confusion as to the exact pathologic entity designated by the term. It has been confused particularly with leukoplakia, for in the later stages of leukoplakia extreme shrinkage often occurs. Kraurosis literally means shrinkage, and in this text it will be used to indicate exactly that.

The histologic picture of kraurosis is that of an atrophic process. The changes in the mucosa and the skin are similar to those seen in senile atrophy of the skin. There is a uniform atrophy of the various layers of the epidermis, with flattening of the rete ridges and merging of the elastic and connective tissue in the cutis.

Following the cessation of ovarian activity, with a resultant withdrawal of the estrogenic hormone, there is a normal physiologic shrinkage of the vulva and the vagina. Great variation occurs in the degree of shrinkage within physiologic limits. In rare instances the shrinkage is excessive, and the atrophic changes of the vulva and the vaginal orifice cause extreme contraction, so that marital relations are impossible. We believe that the term "kraurosis" should be applied to this excessive and pathologic degree of postmenopausal change. As the atrophic postmenopausal vaginal mucosa is subject to abrasions and ensuing infection, so the atrophic skin of the vulva is easily broken, and crevices form through which infection readily enters. The parts become edematous, reddened and indurated as the result of chronic inflammation. The mucosa of the parts becomes smooth, shining and dry, and the folds of mucous membrane and skin become flattened. Often the labia minora disappear completely. The infected skin and mucosa may itch, but often kraurosis vulvae is entirely asymptomatic.

This form of simple kraurosis usually demands no treatment. When it occurs in postmenopausal women, who are relatively young and in whom there is still a desire for sexual intercourse, plastic enlargement of the vaginal outlet is occasionally indicated. A healing ointment, such as that of zinc oxide, can be used to heal the abrasions, and this usually brings relief from the irritation.

In addition to this simple kraurosis there often results, as a late stage of leukoplakia, a marked vulval shrinkage. This is discussed under the section dealing with leukoplakia.

### LEUKOPLAKIA OF THE VULVA

The term "leukoplakia" or "leukoplakic vulvitis" has been confused in the literature and has been used to designate both true leukoplakia and also simple kraurosis which has not true leukoplakia's characteristic—whitish, parchmentlike changes in the skin. In this text we shall use the term "leukoplakia" to include only those cases in which gross whitish changes are visible in the skin. Histologically, they are characterized by changes described below.

In order to define more clearly the nature of the lesion, the histopathology as described by Taussig follows:

*In the early stage we find extensive sub-epithelial leukocytic infiltration with pronounced elongation of the epithelial papillae (acanthosis) and beginning thickening of the keratin layer. In the beginning, nuclear elements are still present to some degree in this keratin layer, and the term parakeratosis has been applied to this stage in distinction from the later hyperkeratosis where only thickly packed keratin fibers are found. In the course of a few months or a year, if the pruritus has been pronounced, there is noted a marked increase in the thickness of the eleidin layer and in the quantity of eleidin deposited in these cells. Since this substance stains very deeply with hematoxylin, this layer often appears as a thick black band beneath the keratin. The epithelial layer in this early hyperplastic stage is as a rule from four to six times thicker than in the normal individual. In the connective tissue there is considerable hyperemia and marked round-cell infiltration. Only toward the conclusion of this stage do we notice increasing connective tissue formation with some sclerosis.*

The late atrophic stage is not an abrupt change. There are gradations between it and the hyperplastic stage so that areas midway between the two are commonly found. Yet the lesions of this late stage are so characteristic and different from the early stage that it seems histologically almost like two diseases. As we approach the late stage we observe increasing hyperkeratosis, pronounced eleidin but lessened acanthosis. The papillae become much flatter and shorter, even though the total thickness of the epithelial layer is still twice that of the normal. There is also diminished round-cell infiltration and increasing sclerosis of the dermis.

The typical late atrophic stage is a very distinctive picture. . . . The epithelial layer in these cases consists of a considerable layer of hyperkeratosis, beneath which is found a thin layer of eleidin cells, and then, with papillae absent, a flat strip of pavement cells that may or may not be covered by a single layer of basement epithelium. In many areas the border of this pavement epithelium appears frayed out and irregular without any sharp distinction from the connective tissue beneath. Even more marked are the changes in the dermis. The round-cell infiltration is in more-or-less circumscribed lymph zones, much less marked than in the early cases, with plentiful plasma

and mast cells scattered through the connective tissue. This connective tissue in many areas directly beneath the epithelial layer undergoes a peculiar collagenous change, forming patches of glairy tissue containing only a few normal cells. . . . I never failed to note some diminution in the amount of elastic tissue between the epithelial papillae of the skin and directly beneath the basement membrane.\*

For some years a very thorough investigation of the cause of leukoplakia has been under way at the University of Michigan. Chemical investigations of the blood and the urine have failed to bring forth any enlightenment as to the etiology. The normal findings have served only to rule out several factors.

#### CLINICAL CHARACTERISTICS

Leukoplakia vulvae is a disease of the menopausal years or beyond. The average age in Taussig's group was 49 years. In three quarters of the total number of patients the menses had ceased, and in the remaining quarter there was clinical evidence of some ovarian dysfunction. Although the cause of leukoplakic vulvitis is not known, there can be little doubt that a deficiency of estrogenic hormone predisposes to its development. In spite of this general statement, however, we have seen a rare case in a young individual with normal ovarian function (in so far as it can be determined by the menstrual history).

The presenting symptom is in almost all instances pruritus, and in most cases this symptom has existed for a period of many months or even for years. The patient may describe the vulval sensation as a feeling of rawness or burning, especially if scratching has caused minute ulcerations. In the later stages of the disease when the vaginal orifice has contracted, dyspareunia may become a major complaint. Remissions occur, but the history, in most cases, suggests a steady progression of the disease.

Grossly, the vulva may be generally and symmetrically involved (Fig. 419) or there may be localized patches of leukoplakia which are most often on the inner aspects of the labia majora or in the region of the

\* Taussig, F. J.: Leukoplakic vulvitis and cancer of the vulva (etiology, histopathology, treatment, five-year results), Tr. Am. Gynec. Soc. 54:60, 1929.

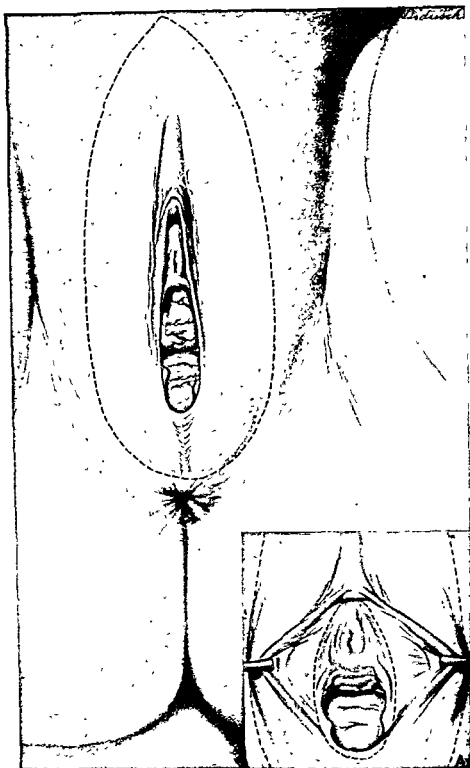


FIG. 419. Conservative vulvectomy for leukoplakia of the vulva. The large oval incision demarcates the outer incision. Inset A shows the inner incision.

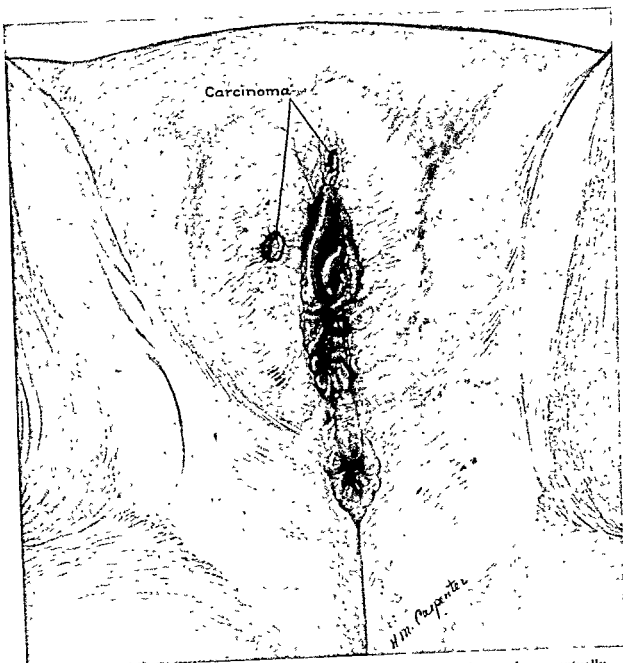


FIG. 420. Long-standing and extensive leukoplakia in which carcinoma has eventually developed.

prepuce. The generalized type of lesion is the more common, but the degree of leukoplakia is not always uniform over the entire area. The preputial folds above and the perineal region below are often the most severely involved. The dull whitened areas are usually thick and parchmentlike in appearance, and small crevices are common. In the advanced atrophic stage the changes in the subepithelial connective tissue produce contractions so

that the labial and the preputial folds are obliterated, and the vaginal orifice is markedly narrowed. This end picture may be properly designated as leukoplakic kraurosis, but not simply as "kraurosis" (Plate 7).

Leukoplakia of the vulva is one of the few conditions in the human body that can be definitely considered as a precancerous lesion. Taussig estimates that approximately 50 per cent of leukoplakic lesions eventually



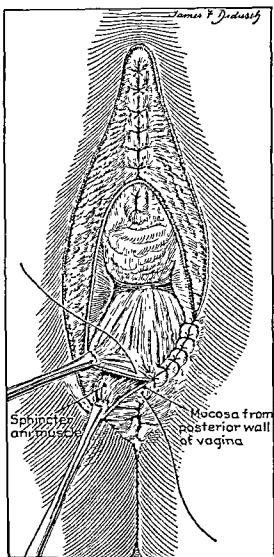


FIG. 421. Demonstrating the method of covering perineum by utilizing a flap of mucosa which has been dissected from the posterior vagina.

ent elsewhere on the vulva. Figure 420 shows an early cancer on a leukoplakic vulva of long standing. Plate 7 shows a similar picture of advanced leukoplakia with beginning cancer.

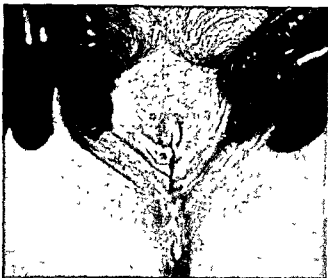
### TREATMENT

Since there appears to be such a direct association between estrogen deficiency and leukoplakia, one naturally turns to endocrine therapy, but supplying estrogens has been disappointing. It is probable that by the time the leukoplakia has become well established, the changes in the skin are irreversible in spite of replacement of adequate estrogen.

When a vaginal discharge from a complicating cervicitis or vaginitis is present, it increases the burning discomfort; hence, the clearing up of this discharge by appropriate treatment may bring some relief. There is only one adequate and safe treatment of leukoplakia—excision. This is dictated by the fact that it is the only method by which the patient can be relieved and also by the proved tendency of leukoplakia to become malignant. In the generalized form of the disease a vulvectomy should be done. When the disease is quite localized to a definite area, local excision of this area is permissible. In some instances we have excised quite successfully the region of the clitoris and the prepuce. The greatest difficulty is encountered in those cases when the perianal region is involved. In such instances, Taussig has practiced leaving a bridge of anal skin on either side, about 1.5 cm. in width. In this manner a grasp is kept on the anal mucosa on either side, and the tendency for the anal mucosa to retract where it is sutured directly to the outside skin is overcome. A small area of leukoplakic skin may be left at the site of these bridges. If these areas of skin are responsible for itching, they may be removed later after the original wound has healed. When there is extensive involvement of the perineum and so much skin requires removal closure is difficult without tension, the perineum may be covered with a vaginal flap. The posterior vaginal wall is dissected free for a distance of 6 to 7 cm. upward as in a perineorrhaphy. A cut of 3 cm. along each vaginal sulcus will

become malignant. We have had occasion to observe a few cases of vulval leukoplakia over a number of years which were not operated upon because of various reasons. Under our observation ulcerations developed which on biopsy showed epidermoid cancer. Approaching the question from the aspect of the fully developed cancer, Smith and Graves found that in 21 vulvas removed for cancer there were 16 in which leukoplakia was pres-

PLATE 7



Marked leukoplakia of long standing. Carcinoma has developed just below the clitoris on the atrophic labium minus.

mobilize this flap sufficiently to permit it to be drawn down over the perineum and sutured there (Fig. 421).

#### TECHNIC: CONSERVATIVE VULVECTOMY FOR LEUKOPLAKIA

Conservative vulvectomy is done partially or completely for leukoplakia, granulomatous lesions and benign tumors. The operation described here is a typical one for leukoplakia which involves all of the inner aspects of the labia majora and extends back to, but does not encircle, the anus.

An elliptical incision is made about the vulva as indicated in Figure 419. It is well to have a fair margin about the leukoplakic skin, but in the case illustrated it was necessary to cut close to the leukoplakic area near the rectum. This incision is best made with the cutting current of the electrosurgical instrument, the bleeding vessels being clamped and coagulated from time to time.

After the outer incision is completed, an inner incision is made in the zone of the carunculae myrtiformes (Fig. 419 A). The two incisions are continued through the vulval fat until they meet, thus excising the vulva.

After complete hemostasis, the subcutaneous tissues are approximated with interrupted sutures of No. 0 chromic catgut. The skin is approximated with a subcuticular continuous suture of No. 0 chromic catgut, using a small cutting needle.

An indwelling mushroom catheter is usually left in the urethra for 10 or 12 days postoperatively.

#### PAGET'S DISEASE OF THE VULVA

Paget's disease of the vulva is indeed uncommon but assumes considerable importance because of its malignant potentialities. It is a definite pathologic and clinic entity. Grossly, the lesion involves the labia, usually unilaterally, and often extends to the clitoris, the perineum and the buttock. The labia are red and edematous, and the lesion itself is brilliant red with small whitish islands of epithelium scattered throughout (Fig. 422). Microscopically, most of the epithelium is thickened and distorted by masses of large clear cells with pale finely granular cytoplasm (Fig. 423). The nuclei vary in



FIG. 422. Paget's disease of the vulva.

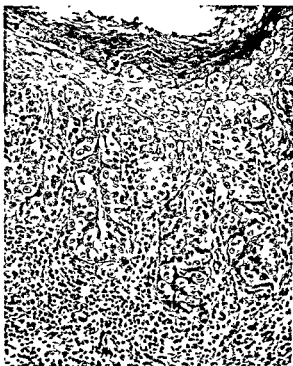


FIG. 423. Paget's disease of the vulva. Note the large clear apocrine cells.

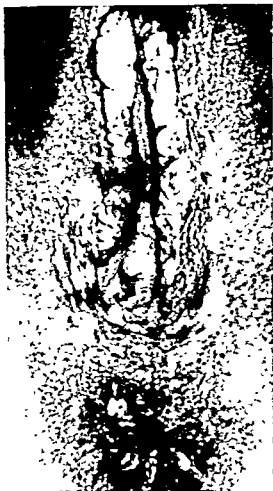


FIG 424 Carcinoma-in-situ of the vulva, associated with extensive leukoplakia in a 33-year-old woman.

size and chromatin. Degeneration and vacuolization is prominent. Mitoses are present but vary considerably in number in different cases. These large clear cells are also seen diffusely throughout the ducts of the sweat glands and the root sheaths of the hair follicles. In some areas masses of these cells seem to form a definite adenomatous tumor not unlike the comedocarcinoma of the breast. The origin of the clear cells is a matter of controversy, but a number of authors believe that the basic lesion is an underlying carcinoma of the apocrine glands and that the cells present in the surface epithelium are metastatic from the carcinoma.

The clinical picture is that of a slowly progressive disease. The usual story is that of

vulval irritation and itching which has existed for months and frequently years. Ointments and often x-ray therapy have usually been tried with little or no success. The disease should be looked upon as a type of intra-epithelial malignancy which may remain as such for many years. That metastases may eventually take place in some cases has been proved by Weiner, Woodruff and Richardson. In fact, in one case of the latter authors the outcome was fatal, and autopsy showed involvement of the uterus, the tubes and the inguinal and the retroperitoneal lymph nodes.

Treatment should consist of wide local excision with careful microscopic examination of the specimen. If no invasion of the subjacent tissues is found, the patient should only be watched, and any suspicious area of skin should be biopsied. If there is microscopic evidence of invasion, regional lymphadenectomy is indicated.

#### CARCINOMA-IN-SITU OF THE VULVA

The importance of recognizing carcinoma of the vulva in its preinvasive stage needs scarcely to be emphasized to the readers of this work who are quite familiar with the high mortality of invasive vulval cancer. Although the vulva is an area which is easily studied by biopsy, there are distressingly large numbers of women with vulval cancer who come to gynecologists after long periods of delay. The reluctance of some elderly patients to submit to an embarrassing examination and the habit of many physicians to prescribe ointments for vulva irritation are undoubtedly responsible for much of this delay.

**Historical Considerations.** Bowen described the first two cases of intra-epithelial carcinoma of the skin in 1912. Both cases occurred in moles. Since then many cases have been reported on the vulva, although it is still a rare disease. Several of the reported lesions have been adjacent to invasive neoplasms, and others have developed invasive cancer after treatment. For example, Gardner, in 1953, described 8 cases, only 2 of which were without invasive cancer, and these 2 subsequently developed invasive

lesions 7 and 11 years after the initial therapy. There have been enough of such cases to establish the relationship between these curable lesions and invasive cancer.

In 1958, Woodruff and Hildebrandt studied 14 cases from the Johns Hopkins Gynecological Pathological Laboratory which represented all the cases recorded since the inception of the laboratory more than 60 years before. However, all but 3 occurred in the last 20 years, probably indicating an increasing alertness in the detection of the condition by patient, practicing physician and pathologist. During the same 20-year period, 58 cases of invasive vulval cancer were seen in one clinic. The average age of the women with the preinvasive lesion was 53, which is, as expected, several years younger than the average age of invasive vulval cancer.

**Symptoms.** Symptomatology varies, but in about half of Woodruff's cases the presenting symptom was itching and/or irritation. Some of the patients complained of a "growth," soreness or pain. One of his cases was found on routine examination.

**Gross and Microscopic Pathology.** There is a great variation in the gross appearance of the lesions. They are described by the examiners in our histories as "punched out," "raised and whitened areas," "leukoplakic areas," "pinkish white and raised," "firm white and glistening," "white, shiny and moist" and "granular" (Fig. 424).

Microscopically, the lesions also vary markedly. The epithelium shows evidence of hyperactivity in various ways, and the depth and the characteristics of the rete pegs vary greatly. Hyperkeratosis, papillomatosis, spinal cell anaplasia, basal cell anaplasia, and parakeratosis are present in different cases in variable degrees. There is no break through in the underlying dermis, but round cell infiltration of the underlying dermis is the rule.

**Diagnosis.** The diagnosis can only be made by biopsy, and more cases will be discovered when biopsying of all suspicious vulval lesions becomes the rule. Since the occurrence of carcinoma-in-situ of the cervix has several times been reported associated with this disease, the cervix should be routinely smeared and biopsied in every case with a suspicion of vulval carcinoma.

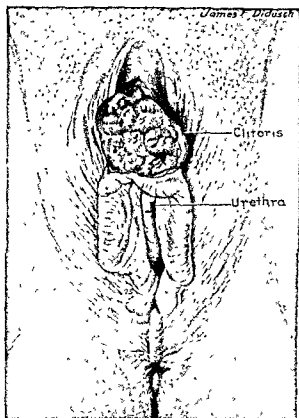


FIG. 425. Carcinoma of clitoris.

**Treatment.** Simple vulvectomy with a wide margin of normal skin is the treatment of choice. It is probable that many of the smaller lesions could be cured by wide local excision without complete vulvectomy, but several cases have seemed to be multicentric in origin. Hence, complete vulvectomy would seem to be good prophylaxis against further trouble. However, the condition may occur in women in the 3rd decade when a functioning vagina is of utmost importance. Hence, in rare instances when the lesion is very small, we have practiced wide local excision rather than resort to complete vulvectomy with resulting danger of constriction of the introitus. If the more conservative excision is done, the patient should be kept under the closest observation. If appreciable invasive cancer is found on microscopic examination of the vulva, lymphadenectomy as described in the section on invasive vulval cancer should follow. All of Woodruff's 14 cases, including a few in which local excision was done, were well at the time of his

report, although in several a 5-year period had not elapsed since the operation.

## CARCINOMA OF THE VULVA

Cancer of the vulva is one of the less commonly occurring malignancies of the genital tract (Fig. 425). Jacoby found it in 1.4 per cent of the cases of genital malignancy; Held in 4.4 per cent; Mattmüller and Lobart in 3.2 per cent; and Clark and Norris found it in a little less than 3 per cent among a large group of cases of malignancy of the female genital tract. Vulval cancer is, for the most part, a disease of advanced years; the average age of incidence is 60. In spite of its major occurrence late in life, we have seen a few cases in the 4th decade and, in the literature, several are reported in the 3rd.

The carcinoma is, in an overwhelming majority of cases, of the epidermoid type. In Taussig's most recent report on 155 cases there were:

- 3 cases of melanoma
- 12 cases of periurethral cancer
  - 1 case of adenocarcinoma, probably of sweat-gland origin
- 3 cases of adenocarcinoma of Bartholin's gland
- 136 cases of epidermoid cancer

## SYMPTOMS AND DIAGNOSIS

The most frequent symptom is pruritus. Since leukoplakia precedes the development of cancer in approximately half of the patients, frequently the pruritus has been present for months and even for years before the appearance of the carcinoma. The cancer is often painful, and, when advanced, the pain may be extreme. Sometimes the appearance of a lump or an ulcer is the first thing that draws the patient's attention to the vulval region. When the cancer breaks down, the ulceration weeps a bloody discharge. One of the presenting symptoms may be a burning on urination; this is due to irritation of the ulcerated area. When a patient complains of any or all of these symptoms, diagnosis usually gives little difficulty after inspection of the vulva. A nodule or raised ulceration, often on an old leukoplakic background, is a characteristic picture, but lymphopathia, tuberculosis and other ulcerative lesions may

simulate carcinoma. In all cases a biopsy should be taken before proceeding with radical therapy.

The disease is usually relatively slow in growing. In spite of this and the fact that the growth is on the exterior of the body, patients often present themselves with very advanced lesions. The reasons for delay are several. Since the disease occurs so frequently in elderly women in whom false modesty is common, there is often reluctance in consulting a physician. Salves and other home remedies are often used until time demonstrates their futility.

## TREATMENT AND DIAGNOSIS

Carcinoma of the vulva is one disease in which prophylactic surgery may be carried out successfully, for we have in leukoplakia a condition which has been demonstrated repeatedly to be a forerunner of cancer. The pathology, its relation to cancer and the surgical treatment of this condition are discussed on page 747. More recently, preinvasive carcinoma of the vulva has been recognized and treated. For consideration of this see page 752.

The first question confronting the gynecologist, after a diagnosis of vulval cancer has been established, is one of operability. Taussig, whose experience with this relatively infrequent disease was considerably greater than that of anyone else in the United States or abroad, claimed that two thirds of the cases were operable when seen by him. Local excision by unqualified surgeons, or irradiation by over-enthusiastic radio'ogists who are not versed in the proper treatment of this disease, contributes to the loss of valuable time.

A careful evaluation of the extent of the lymph-gland involvement is essential in making a decision as to operability. In almost all women inguinal glands are palpable. Infection in the broken-down vulval growth may cause inflammatory enlargement of the glands draining the vulval region; hence, even relatively large glands may be free of cancer. Conversely, glands showing no apparent enlargement may be the site of metastases. Taussig concluded that only when glands are 3 cm. or over in diameter and hard can it be said with reasonable certainty

that metastases are present. In his recent series of 155 cases, 41 per cent showed clinical evidence of lymph-gland involvement, whereas 57 per cent showed unquestioned lymph-gland involvement, either in the form of large fixed glands in the advanced inoperable cases or on microscopic examination of glands removed by partial or complete excision of the lymphatic chain. Since two thirds of the cases are judged as operable by Taussig, it is obvious that he does not consider lymph-gland metastases a contraindication to surgery. Only when there is a large, hard, solidly fixed mass of glands does he consider surgery contraindicated.

The correctness of the attitude that moderate glandular involvement is no contraindication to radical surgery is reflected in Taussig's statistics on his results with the Basset operation. In the group with metastatic cancer there was a "5-year cure" rate of 52.6 per cent which is only 11 per cent lower than the cure rate of the group without metastases.

With experience it becomes quite obvious that the involvement of nodes cannot be determined preoperatively. If this could be done by palpation, it would be a simple matter to perform simple vulvectomy for those without metastases and reserve the radical operation for those with gland involvement. Way found 21 of 36 enlarged nodes (58%) to contain cancer, whereas 15 did not. In 43 patients who had no clinical evidence of gland involvement, 17 (39%) showed carcinoma histologically.

In view of these facts it would appear that radical surgery is the proper therapy for invasive vulval cancer. The operation will obviously be more extensive than is required to cure some cases. On the other hand, since there is no way of being certain that gland involvement does not exist, one cannot logically perform a lesser operation. The superiority of gland dissection over simple vulvectomy is shown by Taussig's results. Nevertheless, in spite of what has just been said, there are occasional cases in very old and feeble women in whom surgical judgment would seem to dictate a simple vulvectomy in view of the mortality of the radical procedures.

#### FIVE-YEAR SURVIVAL RATE

	PER CENT
Vulvectomy with Basset gland resection . . . . .	58.5
Vulvectomy with superficial or incomplete gland resection . . . . .	28.6
Vulvectomy alone . . . . .	8.2
Irradiation alone . . . . .	4.8

More recently McKelvey has reported his results with radical vulvectomy and complete gland resection. Whereas Taussig's statistics of 5-year salvage were based on the two thirds of his cases that were operable, McKelvey's results are based on all cases seen, none of which was rejected because of the extent of the disease or the physical condition of the patient. Slightly over 50 per cent of McKelvey's cases were alive and free from tumor after 5 years.

The results with complete gland resection are so superior to those of other methods that there should be little room for controversy. In spite of this, there is some difference of opinion expressed in recent literature. D. den Hoed concludes that "carcinoma of the vulva is best treated by total or partial vulvectomy, followed by irradiation." He further concludes that if the carcinoma "be accompanied by inguinal glandular metastases the best results are to be expected from wholesale extirpation" Gobel and Hamann have collected combined statistics from various European clinics and from the Mayo Clinic. This group contains cases treated in various ways, but for the most part the method of therapy has been vulvectomy with partial or complete gland resection, combined with irradiation. The 5-year "cure" rate of the combined series is 24.3 per cent. This rate of curability falls far short of equaling the curability rate of either Taussig or McKelvey, using the Basset procedure.

The Basset procedure may be done in 1 or 2 stages. If done in 2 stages the vulvectomy is done first, followed in 2 or 3 weeks by the gland resection. McKelvey strongly urges doing the entire operation as one procedure under local anesthesia. His hospital mortality was only 6 per cent in spite of excluding no cases for extent of disease or physical condition. In 45 Basset operations done on women under 65 years, Taussig re-

ports only 1 death (2%), whereas in 23 operations done on women over 65 years, there were 4 deaths (18%). Since Taussig's over-all operative mortality was in the neighborhood of 7 per cent on selected cases, and McKelvey's was 6 per cent, excluding no cases as inoperable, it is obvious that McKelvey's mortality, using local anesthesia, is less. However, one should bear in mind that McKelvey's series occurred during the chemotherapeutic and antibiotic era, and Taussig's was before. McKelvey attributes his success more to local anesthesia than to any other factor. Certainly he has shown what can be accomplished surgically in this group of elderly patients.

In 1942 Stanley Way first performed in one stage an operation which included a generous resection of the skin over the mons veneris and Scarpa's triangle. With this more radical procedure Way attained an excellent cure rate, but 11 of his 75 patients died in the hospital. He ascribed the high mortality and morbidity to the large wounds which could not be closed per primum. More recently, he has reported his present procedure as an extension of the incision in the thigh, permitting the using of the skin flaps to cover most of his wound surface.

Recently, Ulfelder reported on 53 cases of vulvar cancer treated with a radical operation through a crescentic inguinal incision. In 23 patients there was resection of the superficial lymph nodes only, and in 30 both superficial and deep nodes were resected at the time of the primary operation. There were only 2 hospital deaths among this group. There appeared to be so little difference in the postoperative course in the two groups that it has become his custom to carry out the full procedure in almost every case. With this crescentic incision Ulfelder has prevented skin necrosis, granulations and dense scarring so commonly seen following the Basset procedure. Also, he has noted less lower extremity edema. Twombly has also used and described a technic similar to Ulfelder's. The Basset and the Ulfelder-Twombly technics will be described here.

Irradiation of the vulvar lesion and the gland area is justified only when the lesion is obviously inoperable due to large fixed glands. The results are poor; burning and

discomfort in the perianal region from the irradiation are very annoying.

#### TECHNIC: BASSET OPERATION FOR CARCINOMA OF THE VULVA

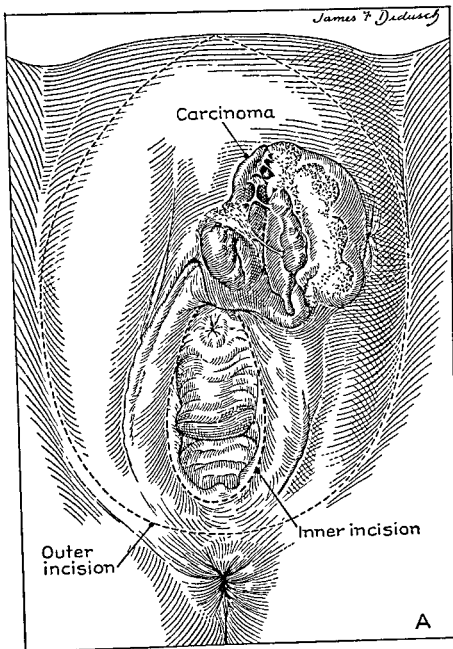
**Stage I. Vulvectomy.** The vulva in which the neoplasm is situated is excised by as wide a margin as possible. It is our custom to do this with the electrosurgical knife. Formerly, it was customary first to excise the vulva with the actual cautery to seal off the lymphatics and then to excise the charred rind with the scalpel in order to obtain primary union. With the present electrosurgical knife, this double excision is not necessary. In making the excision all adjacent leukoplakic skin should be removed with the vulva. Figure 426 A shows the line of excision. Excision should be made liberally and without thought of closure. If closure can be made without undue tension it is desirable; but if not, the tissues should be brought together as well as possible, and that which cannot be covered with skin may be permitted to granulate and become epithelialized. Most of the bleeding can be controlled by applying the coagulating current to the hemostats. A few of the larger vessels may require ligating. The subcutaneous tissues are approximated with interrupted sutures of No. 0 chromic catgut, and the skin and the mucosa are closed with a continuous subcuticular suture of No. 0 chromic catgut. Figure 426 B shows the closure after a rather wide vulvectomy. When the lesion lies on the posterior portion of the vulva, making it necessary to excise the skin of the perineum to ensure removal with a wide margin, often the perineum can be covered with a flap of mucosa dissected up from the posterior vaginal wall (Fig. 421). This procedure also can be utilized when performing vulvectomy for leukoplakia which often extends over the perineum to the rectum.

**Stage II. Modified Basset Lymph-gland Resection.** The second stage of the operation is done usually about 2 weeks after the vulvectomy.

1. An incision is made in the inguinal region, extending obliquely across Poupart's ligament as indicated in Figure 427 A. The length of this incision is variable, depending



FIG. 426. Basset operation for carcinoma of the vulva. (A) A radical vulvectomy is done as indicated by dotted lines.



on the obesity of the patient, but usually an incision of 10 to 12 cm. is necessary.

2. The skin is dissected free from the subcutaneous fat and lymph glands for a distance of about 2 cm. on each side of the incision (Fig. 427 B). The mass of subcutaneous fat and lymphatic tissue is freed from the fascia and dissected downward *en masse* for a distance of about 2 cm. below Poupart's ligament.

3. The external oblique fascia is thus left clean, and the inguinal canal is opened by splitting the external oblique fascia fibers

from the external ring to the point where the round ligament enters the peritoneal cavity (Fig. 427 C). The course of the round ligament is followed upward and outward. The fingers are then pushed inward to open the space in the iliac fossa lateral to the external iliac vessels. In this space there is usually found an almond-sized lymph gland which is dissected free from its bed, keeping it, if possible, in continuity with the tissues attached to the round ligament at its point of entrance to the peritoneal cavity. The round ligament is cut at its median end and dis-

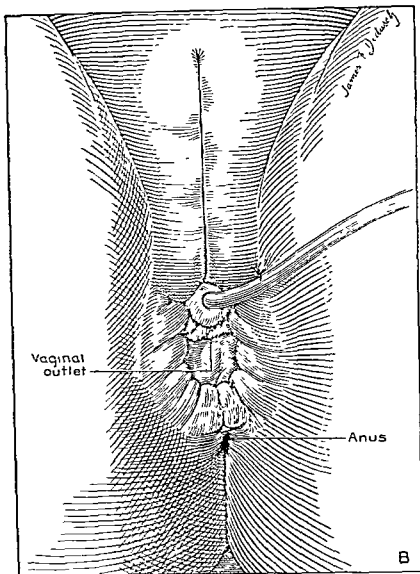


FIG. 426 (*Continued*). Basset operation for carcinoma of the vulva. (B) Completed vulvectomy. Skin and mucosa have been approximated with a continuous subcuticular suture of No. 0 chromic catgut.

sected free from the canal with its attached fatty tissue (Fig. 427 C). It is finally cut and ligated at the lateral end of the inguinal canal, and the mass of tissue is lifted from the inguinal canal. This exposes the deep epigastric vessels which are clamped, cut and sutured at a point close to where they branch from the external iliac vessels (Fig. 427 D). The internal oblique muscles can then be further retracted upward, thus exposing the large vessels and opening up an area where other glands may be found. The gland above the obturator foramen usually has a markedly elongated shape and is about

1 cm. in diameter and 5 cm. in length. Usually these glands can be loosened by the finger without danger of appreciable bleeding.

4. The femoral glands are then resected. The lower skin flap is undercut for 6 to 8 cm. below Poupart's ligament, and all the fat and the lymphatic tissue are dissected cleanly down to the fascia lata. In carrying this dissection downward, the external saphenous vein is encountered as it emerges through the femoral sheath. It is clamped and ligated as shown in Figure 427 E. It is dissected with attached fatty tissue for about

5 cm.; then it is again ligated, cut and removed with the mass of fat and glandular tissue. An alternate method of removing this mass of tissue in the femoral region is first to ligate the external saphenous vein at the lower point and dissect upward, finally ligating it as it emerges from the femoral sheath.

5. In advanced cases when the patient's condition is good enough to justify further surgery, Poupart's ligament may be cut about 1.5 cm. from its attachment to the pubic spine, thus opening up the femoral ring. In the more advanced cases a lymph gland, the "gland of Cloquet," is often found at this point closely attached to the femoral vessels. In most of Taussig's later cases he did not cut Poupart's ligament, reserving this

for the more advanced cases when the general condition is good enough to warrant the more extensive surgery.

If Poupart's ligament has been cut, it is sutured, and the femoral ring is strengthened by the use of the pectineus muscle and fascia. The inguinal canal is closed as in repairing an inguinal hernia. Dead space is obliterated by approximation of the tissues with interrupted sutures of fine catgut. A Penrose drain is placed through the incision down to the lowermost end of the dissected space.

The drain is removed after 72 hours. We frequently apply dry heat to the wounds by use of electric lights. In spite of this, sloughing of the skin edge and infection occur frequently.

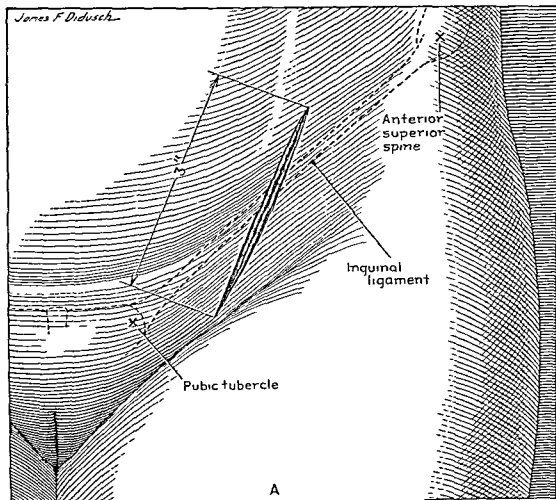


FIG. 427. Basset operation for carcinoma of the vulva. (A) Indicating position and length of incision for gland resection.

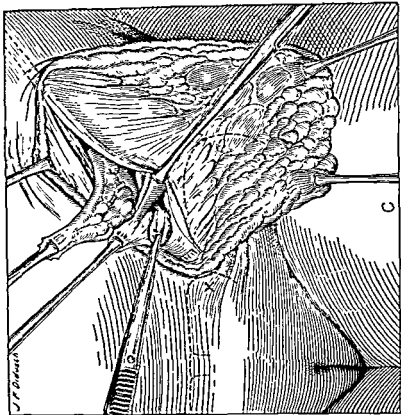
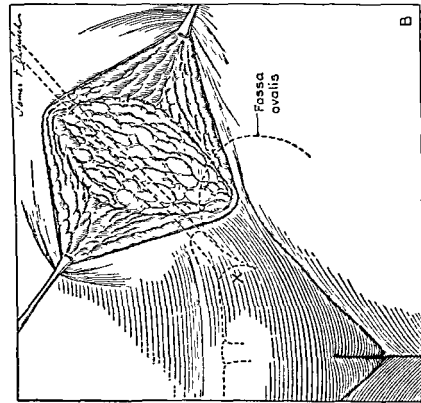


FIG. 427 (*Continued*). Basset operation for carcinoma of the vulva. (B) Flaps of skin are dissected back. (C) The inguinal canal has been opened, the round ligament has been cut. A gland is being removed medial to the vessels.

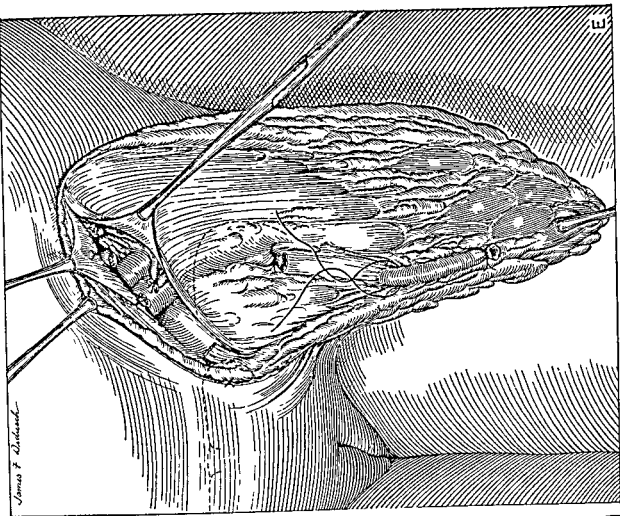
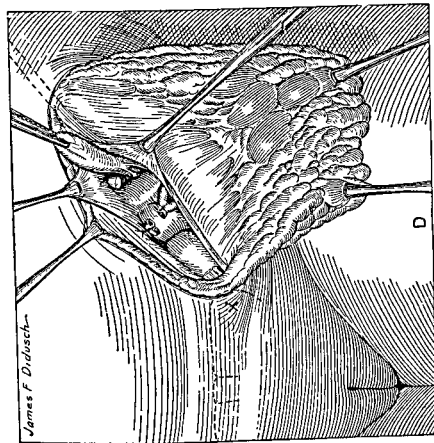


FIG. 427 (Continued). Basset operation for carcinoma of the vulva. (D) Epigastric vessels have been ligated and cut; the round ligament has been removed; and a large gland is being lifted out. (E) Fat and femoral glands are being dissected out en masse. A segment of the saphenous vein is removed with the mass of tissue.

FIG. 428. Skin incisions for radical vulvectomy. The dotted lines indicate the limits of the superficial groin dissections. (Twombly, G. H.: Cancer 6:520)

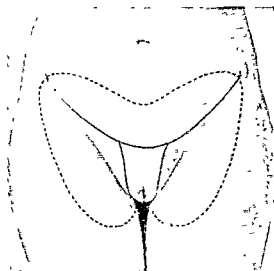
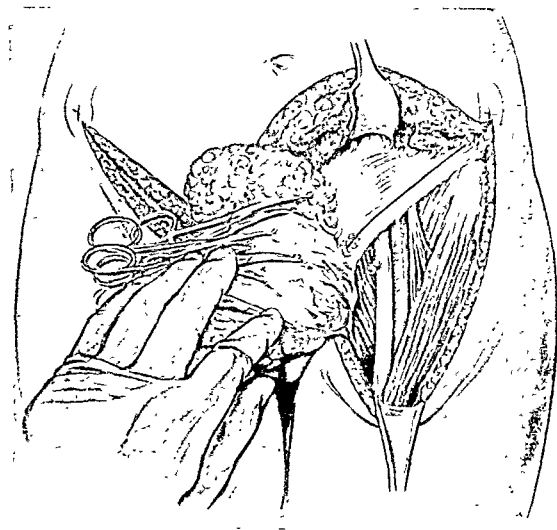


FIG. 429. Scarpa's triangle dissected clean, showing the femoral nerve, artery and vein. The stump of the ligated saphenous vein is seen at its junction with the femoral vein. The round ligament at the external inguinal ring is seen. The incision for the deep pelvic lymph node dissection is indicated, running obliquely outward toward the anterior superior spine. (Twombly, G. H.: Cancer 6:522)



# TECHNIC: TWOMBLY-ULFELDER RADICAL OPERATION FOR CARCINOMA OF THE VULVA

In view of the duration and the extent of the operative procedure as well as the age and the condition of the usual patient, radical vulvectomy with bilateral groin dissection (superficial and deep) should be preceded by detailed study of the cardiovascular and the urinary systems. Both total blood volume and red-cell mass should be determined, and if they are abnormal, indicated adjustments with transfusions of either whole blood or packed red cells should be carried out preoperatively. Electrocardiogram, chest film, intravenous pyelograms and base-line chemical blood levels are obtained in addition to the routine studies prior to any major gynecologic operative procedure. Whole blood should be available for additional transfusion as necessary during surgery.

**Incision and Groin Dissection.** With the patient in the supine position and routinely prepared and draped, a crescent-shaped incision is made, extending from one anterior superior iliac spine to the other, crossing the mons veneris just below the level of the hairline (Fig. 428).

The skin is undermined in as superficial a plane as possible so as to avoid cutting too deeply into the underlying fat and possibly cutting through superficial lying nodes. Figure 428 shows by dotted lines the total area to be undermined. One half of the incision is covered with sterile towels, and the groin dissection is started on the opposite side. The skin flaps bilaterally should be kept warm and moist at all times during the dissection.

At the superior and lateral limits of the undermined incision, dissection is carried out so as to expose the external oblique fascia. The fatty tissue and the glands are separated from the external oblique fascia by sharp dissection from above downward until Poupart's ligament is reached. Then while the assistant elevates the lower flap with the rake retractors, the operator undermines the lower skin flap. The dissection of the fat is then begun from the lateral margin of the incision medially, separating

the fat from Poupart's ligament and the sartorius muscle. In carrying this dissection medially the great saphenous and the lateral saphenous veins will be encountered. They are clamped, cut and ligated. The fascia of the sartorius muscle is dissected free, leaving it attached to the mass of fat and nodes (Fig. 429). Fibers of the femoral nerve are encountered. The branches to the skin must be cut; those lying deeper are exposed.

The femoral artery is encountered from its lateral margin. The sheath of the femoral artery is incised, and the artery is dissected free up to the point where it disappears beneath Poupart's ligament. The femoral vein is exposed, and its sheath is incised. The vein is cleaned of surrounding tissues by dissection from the limits of the incision inferiorly to its entry point into the femoral canal. The great saphenous vein is exposed as it anastomoses with the femoral vein. This vessel is exposed, doubly clamped, doubly ligated and cut. After tying, the vein is transfixed distal to the tie.

As one progresses medially with the dissection, fibres of the pectineus and the adductor longus are exposed, their superficial fascias being included in the specimen as was done with the sartorius muscle laterally. In this area medial to the femoral vein the major lymphatic channels are encountered. These channels are severed just below Poupart's ligament, leaving the ligament intact.

At this stage all of the mass of fat and the superficial inguinal and the superficial and deep femoral nodes will be reflected medially as shown in Figure 430. Dissection is then carried out on the contralateral side. Moist towels are used to cover the recently operated side.

**Removal of the Pelvic Lymph Nodes.** The external inguinal ring is exposed, and an incision is made from the ring upward and laterally in line with the fibers of the fascial sheath and parallel with Poupart's ligament. The incision is extended to the crest of the ileum for adequate exposure. The round ligament and the contents of the inguinal canal are dissected free. The deep epigastric vessels are doubly ligated and cut. The bladder is separated from the nodes and the fat, and the entire mass of tissue is left attached to the specimen.

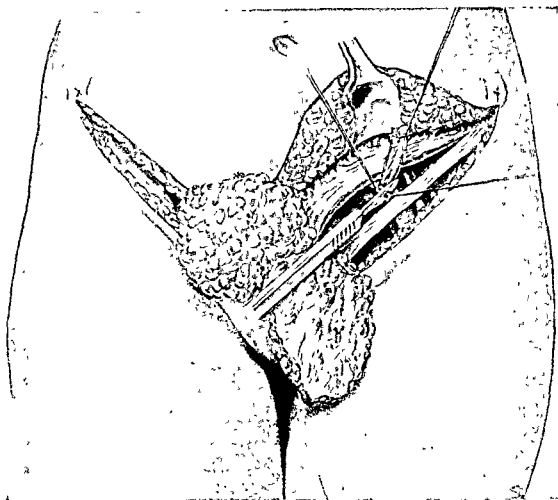


FIG. 430. Abdominal muscles incised, round ligament with fat and deep inguinal nodes dissected out, deep epigastric vessels ligated and cut. (Twombly, G. H.: *Cancer* 6 523)

The peritoneum is retracted upward, exposing the external iliac and hypogastric vessels. The ureter remains attached to the undersurface of the peritoneum and is retracted with it (Fig. 431). Exposure should be obtained as high as the bifurcation of the common iliac artery. Starting from the psoas muscle, the fat and the nodes are peeled from the external iliac artery from Poupart's ligament to the bifurcation. Just inside the ligament and medial to the vein is Cloquet's node, which is apt to be large. The external iliac artery and vein are retracted with a vein retractor, and the obturator fossa is cleaned out by sharp and blunt dissection. If bleeding is encountered, it can be controlled usually by temporary packing.

McKenzie or Sweet clips are quite handy in controlling deep and superficial bleeding from small vessels, both in the obturator fossa and at other points during the node dissection. The obturator nerve is clearly seen. After the field is dry, the incision through the oblique fascia and muscle is closed with interrupted sutures, and the dissection is repeated on the opposite side. The skin edges are freshened by trimming and are approximated, leaving cigarette drains in each lateral angle. The skin is closed, according to the preference of the operator, with silk or skin clips, except for the area above the mons. The specimen which has been displaced medially from each side is covered with gauze (Fig. 432).



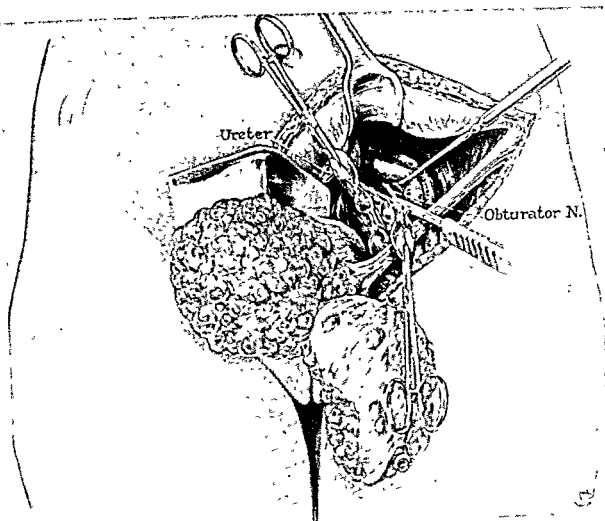


FIG. 431. Dissection of the deep pelvic lymph nodes. A Cushing vein retractor pulls the external iliac artery and vein laterally, exposing the obturator fossa and nerve from which the obturator nodes are being dissected. The lower hemostat is on an external iliac node; the upper, on the hypogastric node. (Twombly, G. H.: *Cancer* 6:525)

**Vulvectomy.** The patient is placed in the lithotomy position for the radical vulvectomy. The incision is best made with the electrosurgical blade. Of course, it is desirable to be able to close the incision primarily. However, too much thought should not be given to this idea while excising the malignant vulval lesion. If the extent of the lesion demands a wider incision than is compatible with closure, the operator should not hesitate to give the lesion a wide berth. Large vessels should be transfixed such as those in

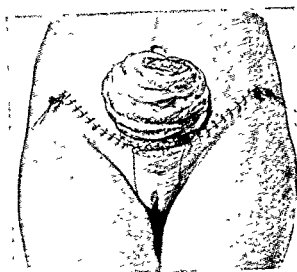


FIG. 432. Skin edges united. Cigarette drains in place. Groin nodes and fat wrapped in gauze. (Twombly, G. H.: *Cancer* 6:526)

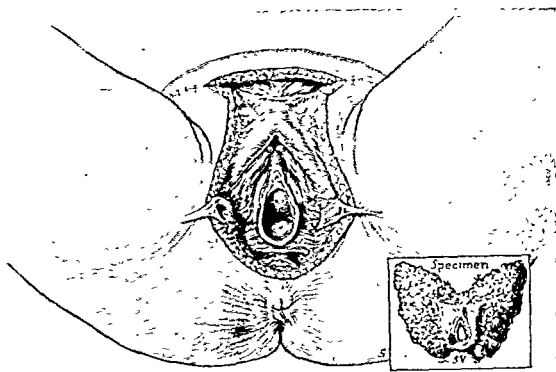


FIG. 433. Extent of usual vulvectomy and excised specimen. Note the ligated corpora cavernosa or crura of the clitoris. (Twombly, G. H.: *Cancer* 6:527)

the area of the clitoris, but lesser bleeding points may be controlled by electrocoagulation. The inner and the outer skin and the mucosal incisions should be made first. If the outer portion of the urethra is encroached upon, a portion of the urethra should be excised with the vulvar specimen. At times, the distal half of the urethra may be excised without resulting in incontinence, but the risk of incontinence should not cause the operator to compromise the cure of malignancy. The dissection of the vulva from its subjacent structures should be done from above downward, removing the tissue from over the symphysis first. After removal of the vulva, the transversus perinei and the rectal sphincter will be visible (Fig. 433). The complete specimen is shown in Fig. 434.

Suction drainage tubes are placed in the wound. The vulvar wound is closed with subcuticular sutures of fine chromic catgut. The skin mucosal incision may be closed to advantage with similar subcuticular catgut sutures. A Foley catheter is placed in the bladder for several days. The wound is ex-

posed to the air beneath a cradle. Heat lamps are used to keep the parts warm and to promote healing. The cigarette drains in the inguinal areas and the suction tubing in the vulvar areas are removed as indicated by decreased drainage. Usually, these may be removed after 3 or 4 days. A small catheter may be placed inside the cigarette drains in the inguinal areas so that antibiotic irrigations may be carried out in the event of infection. Dependent and suction drainage is present as described previously.

Vulvectomy, and especially radical vulvectomy, is complicated at times by stenosis of the introitus. This may be prevented by the use of dilators during the postoperative period. Success depends in a great measure on the persistence of the patient and by her desire to retain function of the vagina.

#### CARCINOMA OF BARTHOLIN'S GLANDS

Carcinoma of Bartholin's glands is one of the rarest malignancies occurring in the female genital tract. About 40 cases have

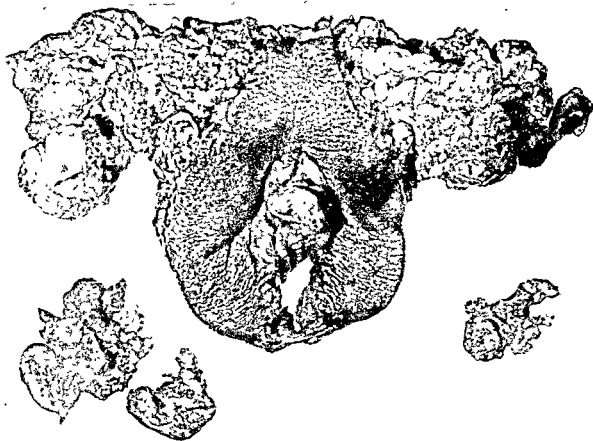


FIG. 434 Complete specimen removed by Twombly-Ulfelder radical operation for carcinoma of the vulva.

been reported in the literature. In 1939 Simendinger reported 38 cases, including his own, but he failed to include 2 cases reported the year before by Rabson and Meeker. Operations for carcinoma of Bartholin's gland constitute about 1 per cent of the operations performed on that gland.

The neoplasm is sometimes first noticed as a small firm and painless nodule in the position of the Bartholin's gland. At first it is well circumscribed, but as the growth extends it infiltrates the surrounding tissue, so that its origin may be difficult to determine from the gross appearance of the lesion. As the growth extends, it may become painful, and often this brings the patient to seek medical advice. As the tumor increases in size, there is a tendency for it to become necrotic, so that the mass may feel fluctuant and be confused with a cyst. One of the best points of differential diagnosis is the age of the patient. The majority of these carci-

nomas occur between the ages of 40 and 55 years, whereas most cysts and abscesses make their appearance in younger women. However, since the chances of a Bartholin lesion are so overwhelmingly in favor of inflammation or a retention cyst, a great proportion of these neoplasms are excised or incised with the belief that they are not neoplastic. Only when the tumor is found at operation to be solid is the true nature recognized.

Histologically, there are two types of Bartholin's gland carcinoma. The majority of the tumors are adenocarcinoma, but several epidermoid cancers have been described. This is possible because the acini are lined by cuboidal cells, and the superficial ducts near the surface are lined with stratified squamous epithelium. The ducts lying between the acini and the superficial squamous-lined ducts are lined by a transitional type of epithelium.



FIG. 435. Basal cell carcinoma of the vulva. Note the elevated edge of the localized lesion

It is often difficult to be certain that a vulval neoplasm arises primarily in Bartholin's gland. Honan has enumerated four criteria which must be satisfied in order to be certain of Bartholin's gland origin: (1) typical vulval location, (2) position deep in the labium, (3) connection with the gland duct and (4) the presence of intact gland tissue. If, in addition to the above, the skin is intact over the growth, one can be certain of the Bartholin's gland origin. Obviously, in advanced cases all of the above criteria cannot be fulfilled.

Extension to the inguinal glands occurs early, and in some cases the femoral glands are also involved. The prognosis is unfavorable, chiefly due to the fact that early diagnosis is infrequent. In 21 cases in the literature in which information is available, Simendinger reports that there was no re-

currence in 1 case after 6 years, in 1 case in 4 years, in 5 cases in 2 years and in 4 cases in 1 year. Five cases recurred, and 5 cases were reported too early after removal of the growth to make a statement of any value regarding recurrence.

The treatment is the radical vulval excision with lymph node dissection as described in the section on vulval cancer. Most students of the subject believe that the tumors are radio-resistant but, even so, one should irradiate following the radical operative procedure if on examination of the specimen it is likely that a complete surgical eradication has not been attained.

### BASAL CELL CARCINOMA OF THE VULVA

Pure basal cell carcinoma of the vulva is a rare lesion, and few gynecologists see more than a very few cases in their professional lifetime. Marcus, who received the literature recently, found approximately 80 cases reported. He calculated its incidence as 2.7 per cent of all vulval malignancies. It is a slow-growing and rarely metastasizing skin lesion which possesses the same characteristics when it occurs on the vulva that it has elsewhere on the body surface. Figure 435 shows the gross lesion with its characteristic slightly elevated rolled edge surrounding a superficial ulcer, and Figure 436 shows the microscopic picture. In order to make an exact histologic diagnosis,\* it is important to biopsy all the ulcerative lesions of the vulva, for an exact histologic diagnosis is necessary for proper definitive therapy. Wide local excision is sufficient to cure basal cell skin cancer elsewhere on the body, as is local irradiation. The same is applicable when the lesion is on the vulva. Because the irradiated skin of the vulva is apt to be uncomfortable due to burning and a feeling of irritation, we prefer not to irradiate this area, since the condition can be cured by wide local excision. This may take the form of a partial vulvectomy. Total vulvectomy is usually not necessary and may result in a constricted introitus. After removal, the total specimen should be subjected to a thorough histologic study to determine whether a good margin of normal skin has been removed. Also, the study is important to make certain

FIG. 436. Low-power view of a section of a basal cell carcinoma of the vulva.



that the lesion is a pure basal cell lesion. If a squamous cell component is present, as is occasionally the case, the lesion should be treated as a squamous cell vulval carcinoma with radical vulvectomy and lymphadenectomy. Even after apparently wide excision, local recurrences occasionally occur which may again be excised locally with an excellent chance of cure.

#### UNUSUAL MALIGNANCIES OF THE VULVOURETHRAL REGION

In addition to carcinoma of the urethra and the vulva, there are some very unusual malignancies which occur in the region of the urethrovulval region which should be mentioned. Recently, Woodruff and Brack collected 12 such cases occurring in a decade ending in 1953 on our service. Five of these were classified as malignant melanomas, 3 as lymphomas, and 4 as fibrosarcomas. During this same period of time, 50 carcinomas of the vulva and 11 primary carcinomas of the urethra were treated on the service. Thus, it is quite obvious that these unusual lesions are rare indeed.

Of course, the diagnosis must be made by biopsy, and therapy has varied. However, in general it has consisted of radical excision followed by x-ray irradiation. The prognosis

is bad, but that it is not hopeless is indicated by the fact that 25 per cent of the cases from our clinic survived more than 5 years. Encouragement for therapy may also be had from Gail and Mallory who found that approximately 10 per cent of 135 lymphomas studied at autopsy showed local lesions which might have been treated adequately by local therapy. We are inclined to believe that local wide excision, coupled with lymphadenectomy is indicated in most cases. The importance of lymphadenectomy is illustrated by one of Woodruff and Brack's cases which survived 8 years in spite of involvement of the inguinal lymph nodes at the time of operation.

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# Surgical Conditions of the Vagina

## IMPERFORATE HYMEN AND ITS COMPLICATIONS

Failure in the formation of a hymenal orifice is a rare congenital malformation. All variations between a complete absence of hymenal orifice to the normal orifice are seen. Figure 437 shows an almost complete lack of orifice, but the small pinhead opening was sufficient to permit the entrance of sperm, and the patient was pregnant when

seen by us. In 1936 Calvin and Nichamin collected 40 cases of imperforate hymen from the literature, but in 1939 Tompkins reported 118 cases, including 5 from his own service. There are, of course, many cases that do not find their way into the literature, but the condition is sufficiently rare that gynecologists with wide experience see only a few cases in their professional lives.

Most of the children are brought to the



FIG. 437. Hymen which is almost imperforate. The pin-headed-sized opening was sufficient to permit pregnancy.



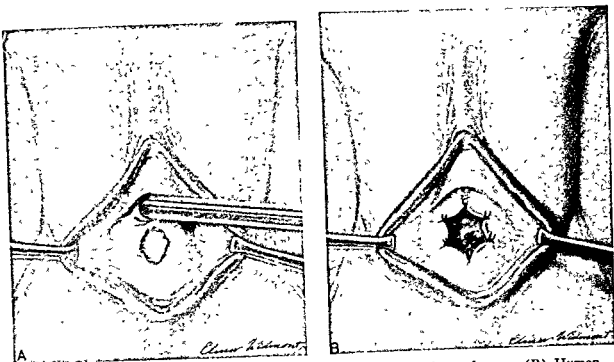


FIG. 438 Excision of imperforate hymen (A) Showing imperforate hymen. (B) Hymen has been excised, and cut edges sutured.

gynecologist at the age of 13 to 15 when, on failing to menstruate, they develop symptoms which call the matter to the mother's attention. Occasionally, an observant mother will notice the absence of an orifice in the hymen and bring the child for consultation before puberty (Fig 438 A). At this time, the condition is entirely asymptomatic, and on incising the hymen the vagina will be found to contain mucoid fluid which is accumulated cervical secretion.

The symptoms that appear after the onset of puberty are due to the accumulation of menstrual blood. The blood of the first period or two is collected in the vagina, which is quite capable of holding it, without undue stretching and without the development of symptoms referable to it. This accumulation of menstrual blood in the vagina is known as *hematocolpos*. The child may feel a little below par and have crampy discomfort suggesting menstruation, but no blood appears at the vaginal outlet. As menstruation recurs, the vagina becomes greatly overdistended, and the cervical canal also dilates. Then the menstrual blood accumulates in the uterine cavity, forming *hematometra*. When the intra-uterine pressure reaches a certain point, there is retrograde passage of blood into the

tubes, forming *hematosalpinx*. Adhesion formation within or at the fimbriated ends of the tubes may seal them off, and little or no blood may enter the peritoneal cavity. However, in some cases blood passes freely into the peritoneal cavity, forming *hematoperitoneum* (Fig. 439).

Pains in the lower abdomen, the pelvis and the lower back constitute the commonest complaint. These pains are often aggravated on defecation, and urination may also be difficult. Pressure of the distended vagina upon the urethra may completely close the urethra and prevent emptying of the bladder. The overdistention usually causes recurring cramplike pains in the suprapubic region. Overflow incontinence may develop eventually. The more common urologic symptoms are dysuria, frequency and urgency. In most of the cases in the literature the urinary tract has not been investigated, but Trafton and Ewart report a case in which a thorough urologic study was made. The patient complained of flank pain, and intravenous urography revealed bilateral hydro-ureters and hydronephroses. The back pressure on the upper urinary tract was due to elevation of the trigone and the lateral spread of the pelvic ureters by the hematocolpos. The tri-

gonal displacement was easily demonstrated by cystoscopic examination. A follow-up study of the upper urinary tract showed the ureters and the kidney pelves to have returned to almost normal following surgical treatment of the imperforate hymen.

On abdominal examination a tender mass is often palpable suprapubically. The mass is due to uterine enlargement and displacement upward, tubal enlargement, a distended bladder or a combination of these conditions. When there is hematooperitoneum, there may be all the symptoms and the signs of peritonitis, due to irritation of the free blood. On inspection of the vulva, protrusion of the hymen is usually plainly visible; in some instances the protrusion is massive and dark in color due to the old blood's showing through the stretched mucous membrane.

## TREATMENT

If the congenital defect is discovered before puberty, the hymenal membrane is simply excised, and the cut edges are sutured with fine catgut (Fig. 438 B). If hematocolpos has developed, all unnecessary instrumentation should be avoided. The old blood is an excellent culture medium, and the natural barrier to the uterine cavity at the internal cervical os may have been done away with by the formation of hematocolpos (Fig. 439). Severe infections have been reported following surgical procedures and the patient should be given antibiotics preoperatively and postoperatively. A simple crucial incision is made in the hymen as shown in Figure 440. Then the quadrants of the hymen are excised. Nothing more is done surgically

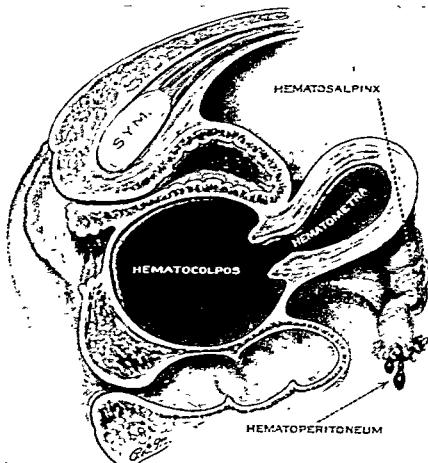


FIG. 439. Imperforate hymen, resulting in hematocolpos, hematometra, hematosalpinx and hematooperitoneum.

at this time, and the patient is placed in Fowler's position to facilitate the drainage. In most instances the mass formed by the hematocolpos and the hematometra disappears gradually. If the mass does not disappear within a reasonable time, inspection of the cervix should be done to make certain that drainage from the uterus is satisfactory. In rare instances, when there is evidence of a great amount of blood in the peritoneal cavity, a laparotomy should be done and the peritoneal cavity cleansed of the blood to avoid organization of the blood and adhesion formation. Since these patients are in their early teens when they come to treatment, one should be restrained from doing salpingectomy or hysterectomy, even though the condition of the pelvic organs seems to be very abnormal as a result of the distention with blood. It is conceivable that a rare case will eventually require hysterectomy and salpingectomy, as a result of chronic discomfort caused by the residue of the condition.

#### ATRESIA OF THE VAGINA AND THE VAGINAL OUTLET

In addition to the congenitally imperfor-

ate hymen, there are other narrowings of the vagina and the vaginal outlet that are of clinical importance which may require surgical correction.

Agglutination of the labia minora occasionally occurs in infancy, shutting off the vagina and, at times, the urethral meatus (Fig. 441). If the mother or the nurse has had previous experience in bathing female children, she may notice the difference in conformation of the vulva. We have seen a rare case in which complete sealing together of the labia minora prevented voiding, and for this the mother sought advice. In order to explain the healing together of the labia minora, one must assume that there has been some inflammatory process. Evidently, this is of a mild nature, for it escapes the attention of the mother. We never have seen agglutination of the labia result from a neisserian vaginitis. The treatment consists of separation of the labia. Usually this can be carried out easily, without anesthesia. The child will cry as this is done, but the displeasure of the child does not equal that of taking an anesthetic. After the labia have been separated, the mother is advised to bathe the parts carefully and apply petro-

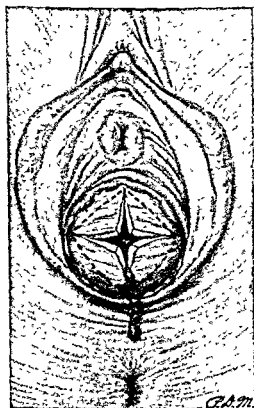


FIG. 440 (Left). Excision of imperforate hymen, following retention of menstrual blood.

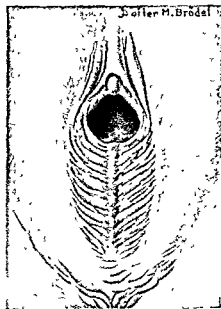


FIG. 441 (Right). Agglutinated labia minora.

latum until the abraded area has become completely epithelialized.

The next age group in which atresia is of clinical significance consists of women of marriageable age who present themselves for premarital examination, or who, after marriage, find that coitus is painful or impossible. The result of education has brought more and more women to gynecologists for premarital examinations. One of the principal points on which they seek advice is whether or not they possess any physical handicap to carrying on normal sexual relations. The virginal hymenal orifice varies in size from that of a pinhead to that which will admit 2 fingers without much discomfort. There is great variation also in the elasticity of the hymen. A rigid hymen may be very painful and resistant at the slightest attempt at dilatation. If the size of the orifice or the resistance of the hymen suggests that coitus will be attended with much discomfort, the hymen should be ruptured under Pentothal Sodium anesthesia at least a month before marriage. This dilatation can be done with the gloved fingers with a minimum of anesthesia. Very rarely is there appreciable hemorrhage. If there is a venous ooze, a gauze sponge placed in the vaginal orifice for a few hours will control it. On very rare occasions a small artery will require ligation. The patient is asked to return to the office after a week. At this time 2 fingers are gently introduced into the vagina and spread carefully to make certain that the rent in the hymen does not heal together. Then the patient is instructed to take daily douches for a week or two. The introduction of the douche nozzle is sufficient to keep the hymenal rent from healing together, and the irrigation keeps the healing parts clean. The importance of this slight operation in selected cases cannot be overemphasized. It may mean the difference between a well-adjusted marital life and one that starts badly and never becomes satisfactory.

The next age group that may seek relief because of atresia of the vaginal outlet is composed of postmenopausal women. This group is not limited to elderly women after the natural menopause. Surgical castration and irradiation may cause shrinkage of the

outlet in young women. In fact, in these younger women treatment is most often necessary. With the withdrawal of the estrogenic hormone, there is always a certain degree of shrinkage of the vulva and the vaginal outlet. The maximum of this is seen in kraurosis, but lesser degrees of it are sufficient to give rise to dyspareunia. If the woman is parous, slight shrinkage is not disadvantageous, but in the nulliparous woman the resulting orifice may become too small to permit painless coitus. Surgeons are responsible for a number of cases, for they are prone to repair the perineum too tightly. Little or no difficulty may result until postmenopausal shrinkage sets in. Then coitus may become painful and, at times, impossible, so that surgical measures are necessary. Longitudinal incision through the perineum and the transverse closure of the incision shortens the vagina slightly but increases the caliber of the outlet quite satisfactorily (Fig. 442). The incision may be carried down to the rectal sphincter, but care must be exercised to prevent cutting the bowel wall. Occasionally, two bilateral incisions may be preferable to one in the mid-line.

Using stilbestrol vaginal suppositories (0.5 mg.) builds up the thickness of the vaginal mucosa and thus may help the dyspareunia also. Generally, about 2 weeks of using the suppositories nightly is necessary before the full estrogen effect is attained. After it is attained, often the status can be maintained by inserting a suppository twice a week.

### BENIGN TUMORS OF THE VAGINA

Fibromyoma of the vagina is exceedingly rare, less than 200 being reported in the literature. In 1941 Bennett and Ehrlich reported 9 cases from our gynecologic pathology laboratory and an additional 3 from the private practices of the staff members. The 9 cases were among more than 50,000 gynecologic pathology specimens. In spite of the fact that more than half of the pathologic material in which Bennett and Ehrlich found their cases was from colored patients, 9 of the patients with vaginal myoma were

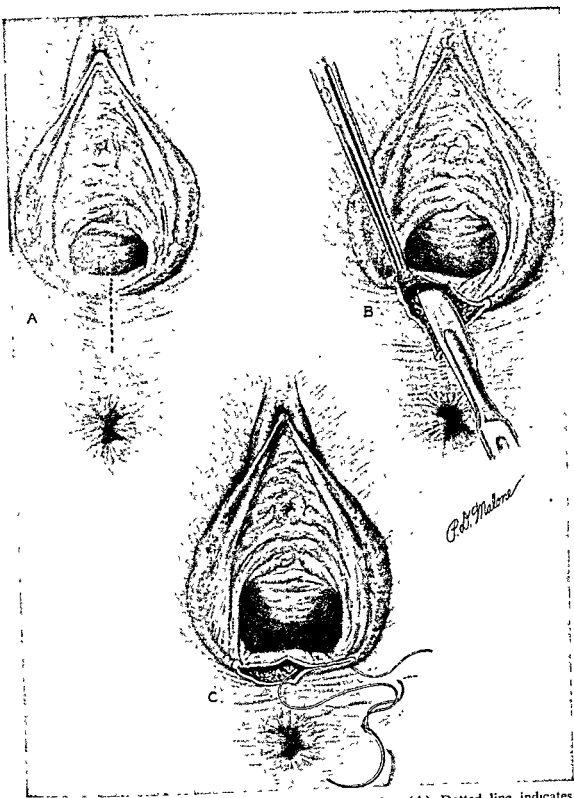


FIG. 442. Operation for enlargement of vaginal outlet. (A) Dotted line indicates incision of too tightly repaired perineum. (B) Vaginal flap is freed. (C) Incision is closed transversely in the Heineke-Mikulicz manner.

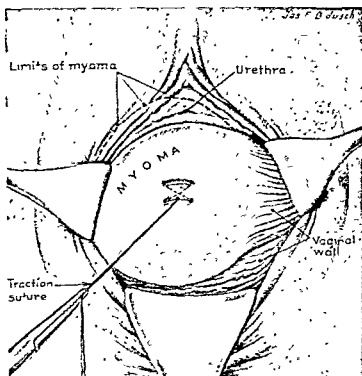


FIG. 443. Vaginal myoma, growing in the lateral wall of the vagina. It is exposed for removal by traction suture.

white, and 3 were colored. Hence, there is a reversal of the racial tendency to fibromyomata in the uterus.

The tumors occur anywhere in the vaginal wall, and the great majority are encapsulated (Fig. 443). The usual degenerative changes found in uterine myomata have been reported in these vaginal tumors, except sarcomatous, for which the literature gives no conclusive evidence.

The development of symptoms depends on the size and the position of the tumor and the ulcerative changes that may take place in the overlying mucosa. A protruding mass may be noticed, or the presence of the tumor may interfere with intercourse. In a considerable number of the reported cases, urethral obstruction has resulted in difficulty and/or frequency of urination. In one case in the literature, acute urinary retention occurred, and in another urinary incontinence resulted. In our cases, there were none in which ulceration of the overlying vaginal mucosa was present, with bleeding, but such cases have been reported.

The important thing in making a differen-

tial diagnosis is to bear in mind the possibility of this type of tumor. Mistaken diagnosis of cystocele, urethrocele, prolapsus uteri, vaginal cyst and even adenomyoma have been made. Careful pelvic examination, noting particularly the consistency of the mass and its relation to other organs, usually is sufficient to make a reasonably certain diagnosis. When the lesion is in the anterior vaginal wall, a cystoscopic examination may be helpful.

The treatment is excision of the encapsulated tumor. If it lies in the lateral vaginal wall, considerable hemorrhage may be encountered during the operation. Great care should be used to have a dry operative field and to obliterate carefully all dead space before closure of the mucosa.

*Endometriosis* of the posterior vaginal vault occasionally occurs as an extension of endometriosis downward from the cul-de-sac. The condition is considered in the chapter on endometriosis.

The only additional benign vaginal tumor worthy of mention is the papilloma (Fig. 444). Aside from venereal warts, one very

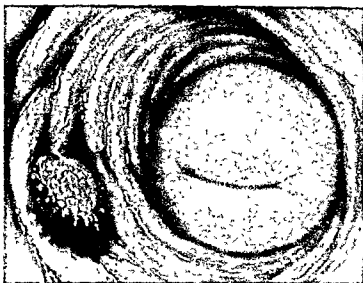


FIG. 444. Benign vaginal papilloma.

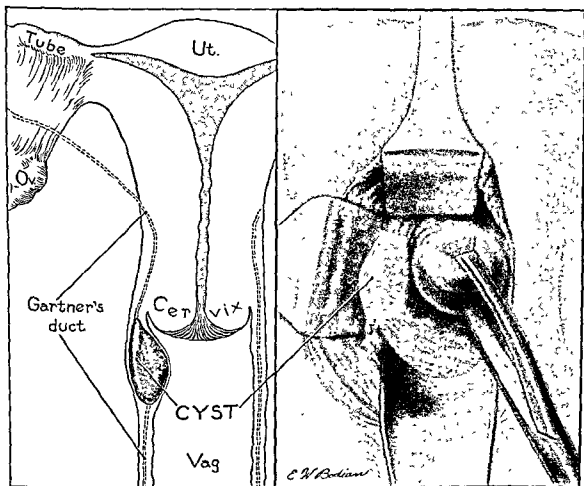


FIG. 445. Cyst of Gartner's duct. (Left) Shows origin of epithelium which lines the cyst wall in the upper vagina. (Right) Shows appearance of the cyst viewed through the vagina. It is excised in the same manner as any vaginal retention cyst, but, owing to its high position, it may be rather difficult.

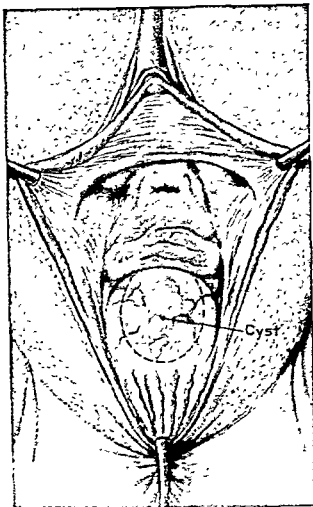


FIG. 446. Excision of vaginal inclusion cyst. The cyst is shown in the posterior vaginal wall in the mid-line. The stretched vaginal mucosa is cut as indicated by the dotted line. The cyst is then enucleated, and submucosal tissues are approximated. The mucosal incision is closed in the mid-line.

rarely encounters a single vaginal papilloma that may become ulcerated and bleed. Local excision is the treatment, followed by microscopic examination to make certain of the benign nature of the growth.

#### CYST OF THE VAGINA

*Cysts of Gartner's duct* are not common but occur sufficiently frequently to necessitate their recognition by the gynecologist. They result from the imperfect obliteration of the lower portion of Gartner's ducts and subsequent secretory activity of the epithelium. Gartner's ducts extend downward from the broad ligaments into the anterolateral walls of the vagina (Fig. 445). Hence, these cysts can be recognized by their anterolateral position. Usually they are small, and since one can be quite certain of their benign

nature, they do not require removal. However, occasionally they become large enough to protrude from the vaginal outlet and be annoying. Then they should be excised; this is accomplished easily by blunt and sharp dissection. After removal, these cysts may be identified microscopically by their lining of cuboidal or columnar epithelium. According to Novak, flattened stratified squamous epithelium is occasionally seen lining part of the cyst wall.

*Vaginal inclusion cysts* are more common than cysts of Gartner's duct (Fig 446). They may be distinguished from the latter by the fact that they occur lower in the vagina and are usually on the posterior or the lateral wall. They are formed as the result of the accidental burying of bits of epithelium in the course of the healing of an obstetric



tear or a surgical repair of the perineum. The bits of buried vaginal mucosa then begin to proliferate, and a cyst is formed, filled with desquamated epithelium, which material is grossly sebaceous in character. Most of the cysts are small and, giving no symptoms, do not require surgical removal. However the one pictured in Figure 446, was sufficiently large to be annoying to the patient. It was removed through an incision indicated by the dotted line.

### PRIMARY CARCINOMA OF THE VAGINA

The first case of primary vaginal carcinoma was recorded in the literature by Cruviellier in 1826. It is one of the rarest pelvic cancers, being estimated at 1 to 2 per cent of malignant pelvic neoplasms. A little over 100 years after Cruviellier's report, Jashke estimated that about 200 cases had been recorded up to 1928. Since then approximately 250 cases have been added.

It is a disease of middle life. Emmert reported the age limit of the cases at the Barnard Free Skin and Cancer Hospital as ranging from 26 to 82 years, the average age being 53 years. In a series of 110 patients treated at the Memorial Hospital the average age was 55.7 years.

Vaginal cancer appears in two principal clinical forms. The least common type is a superficial rather widespread lesion which may be polypoid or resemble senile vaginitis. The more common form infiltrates the subjacent tissues early, converting the part of the vagina which is involved into a rigid tube. The surface of such growths appears as an ulcer. Any part of the vagina may be the site of origin, and different series differ widely in the percentage of occurrence at different levels of the vagina.

The majority of these patients present themselves with vaginal bleeding, and since the majority are postmenopausal it is the appearance of blood some years after the cessation of normal periods which brings them to the physician. Postcoital bleeding may be the first sign or simply the appearance of a discharge in which no gross blood is detected. A few of our cases complained of pelvic pain, indicating extension beyond the vagina.

Because of the proximity of the thin-walled vagina to the rectum and the bladder, adequate treatment is difficult, either by surgery or by irradiation. However, the condition is not hopeless, as will be shown by the results reported by Brack from our clinic. It is our belief that the primary attack should be irradiation. In recent years, Brack has used multiple radium sources in tandem enclosed in a cylindrical lucite applicator wide enough to distend the vagina. The dosage should be planned to deliver at least 10,000 r to the tumor. This should be combined with deep x-ray therapy to the pelvis, given through multiple fields. A tumor dose of 3,000 to 3,500 r should be the goal of the roentgen irradiation. In radium-resistant cases, radical surgery is worthy of trial. The extent of the surgery should vary according to the extent and the location of the growth. Complete vaginectomy combined with complete hysterectomy and double salpingo-oophorectomy may be carried out as shown in Figures 447 and 448. When exploring the abdomen the surgeon should carefully palpate for pelvic lymph nodes; if even suspicious nodes are present, the regional nodes should be removed. If there has been extension into the bladder or the rectal wall, either anterior or posterior exenteration may be considered. If there is extension to both rectum and vagina, it is almost certain that the patient could not be cured by total exenteration, and we do not believe that it should be attempted.

Six of the 13 women treated in our clinic were considered to have had adequate treatment by Brack, and 4 of these are living and well. Two were treated only 1½ years ago and are well, but one is alive after 11 years, and the 4th after 5 years. Six of the cases had inadequate treatment as judged by present-day standards, and 3 of these died within a year; but one is well 11 years, and the 2nd is well after 5 years. The 3rd had a recurrence and was treated by anterior exenteration. She is well after 5 years. The 13th case is clinically well 4 years after a low dose of radium and x-ray. Of the 10 patients in Brack's series who were treated 5 or more years ago, 4 are living and well. Excluding 1 patient who refused treatment, the relative 5-year survival rate is 44.4 per cent. Thus, it became evident that although treat-

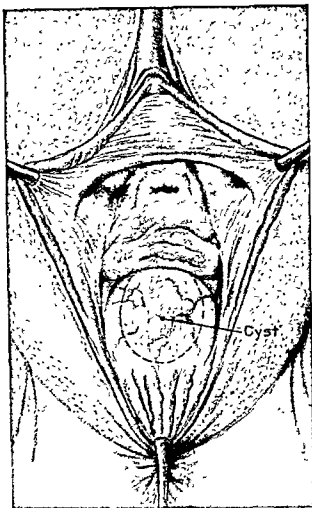


FIG. 446. Excision of vaginal inclusion cyst. The cyst is shown in the posterior vaginal wall in the mid-line. The stretched vaginal mucosa is cut as indicated by the dotted line. The cyst is then enucleated, and submucosal tissues are approximated. The mucosal incision is closed in the mid-line.

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#### CYST OF THE VAGINA

*Cysts of Gartner's duct* are not common but occur sufficiently frequently to necessitate their recognition by the gynecologist. They result from the imperfect obliteration of the lower portion of Gartner's ducts and subsequent secretory activity of the epithelium. Gartner's ducts extend downward from the broad ligaments into the anterolateral walls of the vagina (Fig. 445). Hence, these cysts can be recognized by their anterolateral position. Usually they are small, and since one can be quite certain of their benign

nature, they do not require removal. However, occasionally they become large enough to protrude from the vaginal outlet and be annoying. Then they should be excised; this is accomplished easily by blunt and sharp dissection. After removal, these cysts may be identified microscopically by their lining of cuboidal or columnar epithelium. According to Novak, flattened stratified squamous epithelium is occasionally seen lining part of the cyst wall.

*Vaginal inclusion cysts* are more common than cysts of Gartner's duct (Fig 446). They may be distinguished from the latter by the fact that they occur lower in the vagina and are usually on the posterior or the lateral wall. They are formed as the result of the accidental burying of bits of epithelium in the course of the healing of an obstetric

tear or a surgical repair of the perineum. The bits of buried vaginal mucosa then begin to proliferate, and a cyst is formed, filled with desquamated epithelium, which material is grossly sebaceous in character. Most of the cysts are small and, giving no symptoms, do not require surgical removal. However the one pictured in Figure 446, was sufficiently large to be annoying to the patient. It was removed through an incision indicated by the dotted line.

### PRIMARY CARCINOMA OF THE VAGINA

The first case of primary vaginal carcinoma was recorded in the literature by Cruviellier in 1826. It is one of the rarest pelvic cancers, being estimated at 1 to 2 per cent of malignant pelvic neoplasms. A little over 100 years after Cruviellier's report, Jashke estimated that about 200 cases had been recorded up to 1928. Since then approximately 250 cases have been added.

It is a disease of middle life. Emmert reported the age limit of the cases at the Barnard Free Skin and Cancer Hospital as ranging from 26 to 82 years, the average age being 53 years. In a series of 110 patients treated at the Memorial Hospital the average age was 55.7 years.

Vaginal cancer appears in two principal clinical forms. The least common type is a superficial rather widespread lesion which may be polypoid or resemble senile vaginitis. The more common form infiltrates the subjacent tissues early, converting the part of the vagina which is involved into a rigid tube. The surface of such growths appears as an ulcer. Any part of the vagina may be the site of origin, and different series differ widely in the percentage of occurrence at different levels of the vagina.

The majority of these patients present themselves with vaginal bleeding, and since the majority are postmenopausal it is the appearance of blood some years after the cessation of normal periods which brings them to the physician. Postcoital bleeding may be the first sign or simply the appearance of a discharge in which no gross blood is detected. A few of our cases complained of pelvic pain, indicating extension beyond the vagina.

Because of the proximity of the thin-walled vagina to the rectum and the bladder, adequate treatment is difficult, either by surgery or by irradiation. However, the condition is not hopeless, as will be shown by the results reported by Brack from our clinic. It is our belief that the primary attack should be irradiation. In recent years, Brack has used multiple radium sources in tandem enclosed in a cylindrical lucite applicator wide enough to distend the vagina. The dosage should be planned to deliver at least 10,000 r to the tumor. This should be combined with deep x-ray therapy to the pelvis, given through multiple fields. A tumor dose of 3,000 to 3,500 r should be the goal of the roentgen irradiation. In radium-resistant cases, radical surgery is worthy of trial. The extent of the surgery should vary according to the extent and the location of the growth. Complete vaginectomy combined with complete hysterectomy and double salpingo-oophorectomy may be carried out as shown in Figures 447 and 448. When exploring the abdomen the surgeon should carefully palpate for pelvic lymph nodes; if even suspicious nodes are present, the regional nodes should be removed. If there has been extension into the bladder or the rectal wall, either anterior or posterior exenteration may be considered. If there is extension to both rectum and vagina, it is almost certain that the patient could not be cured by total exenteration, and we do not believe that it should be attempted.

Six of the 13 women treated in our clinic were considered to have had adequate treatment by Brack, and 4 of these are living and well. Two were treated only 1½ years ago and are well, but one is alive after 11 years, and the 4th after 5 years. Six of the cases had inadequate treatment as judged by present-day standards, and 3 of these died within a year; but one is well 11 years, and the 2nd is well after 5 years. The 3rd had a recurrence and was treated by anterior exenteration. She is well after 5 years. The 13th case is clinically well 4 years after a low dose of radium and x-ray. Of the 10 patients in Brack's series who were treated 5 or more years ago, 4 are living and well. Excluding 1 patient who refused treatment, the relative 5-year survival rate is 44.4 per cent. Thus, it became evident that although treat-

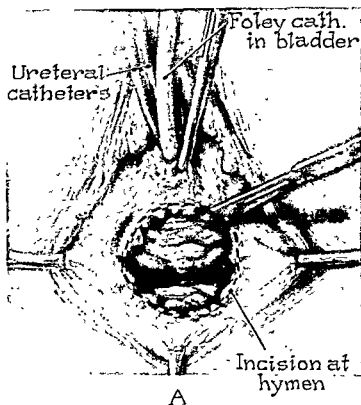
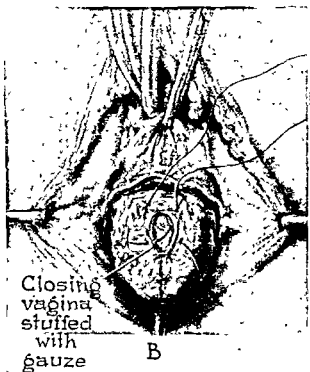


FIG. 447. For total vaginectomy the operation is started below and completed above after stuffing the vagina with gauze and then closing the vaginal wound as shown in C.



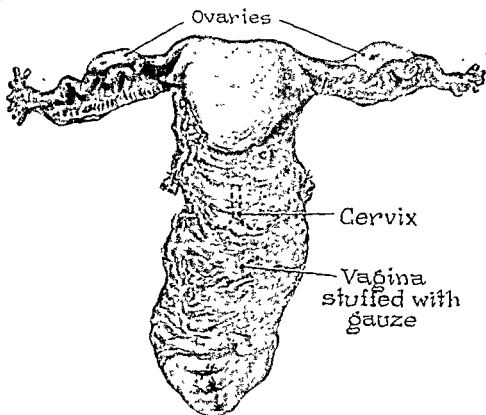


FIG. 448. Entire specimen removed for primary carcinoma of the vagina. The operation was started below as shown in Figure 447 and completed above.



FIG. 449. Sarcoma botryoides. Note the edematous appearance of the tissue.

ment of primary vaginal cancer is technically difficult, the ultimate results are better than in several other forms of malignancy.

### SARCOMA BOTRYOIDES

Sarcoma botryoides is a descriptive term for a grapelike tumor arising from the cervix and/or from the vagina. The first case arising from the vagina was reported by Guersant in 1854. Weber reported a similar tumor arising from the cervix in 1867. Since then reports of a few of these extraordinary tumors have appeared in the literature; the total number is in the neighborhood of only 150. It is usually a disease of infancy, and cases have been reported in the newborn. Rarely, cases have been reported later in life.

The characteristic history is that of an infant whose mother has noted a pinkish watery discharge. On examination a gelatinous yellowish-pink polyplike structure is usually seen protruding from the infant's hymenal orifice. In gross appearance the polyplike structure does not suggest the malignant tumor which it is. From the appearance of multiple polyps on the vagina and the cervix the possibility of multicentric origin is strongly suggested. Fortunately, the disease is extremely rare. When one is encountered, the physician usually has no previous clinical experience with the disease. Hence, the polyplike structure may be considered a benign polyp or even a prolapsed urethral mucosa, and valuable time is lost. In advanced cases the entire vagina may be filled with polypoid material which is attached to the cervix and the vagina, and the growth may extend laterally to the pelvic walls.

Microscopically, the tumor is unmistakably malignant, composed of sarcomalike cells separated by much edema (Fig. 449). Other mesodermal elements, such as embryonic striped muscle or even cartilage, are occasionally present. Rarely, the surface epithelium appears to be hyperactive and possibly also malignant.

The tumors are extremely malignant and almost uniformly progress fatally, usually within 2 years of the onset of the symptoms. The fatal outcome seems to be almost inevitable, regardless of early diagnosis. However, there are isolated cases in the literature

of survival for several years. Daniel, who has recently surveyed the literature, failed to find any reported cure by irradiation therapy alone. He did find 2 cases of survival for 9 and 11 years, respectively, after local excision and irradiation. Since 1947 radical surgery has been used more freely. Ulfelder and Quan report a case of a 26-month-old infant treated by a Wertheim hysterectomy and total vaginectomy by Meigs. She was well at 13 years. Shackman performed a vulvectomy, a vaginectomy, a hysterectomy, resection of the bladder, and pubic ramus in a 4-year-old child who was well 11 years after the surgery. Richmond, Gross and Ober report cases treated by hysterectomy and vaginectomy who are well 6 years, 3 years and 3 years, respectively. Finally, Daniel reports one 5-year survival of a woman who was treated at 21 by irradiation and subsequent total exenteration by Brunschwig. This is the only known 5-year survivor after total exenteration for this disease. Daniel performed anterior exenteration in one case, and the patient was well at the time of the report, 3 years later.

The above isolated cases are the very few successfully treated ones among the many fatal cases. However, they are sufficient to cause one to attempt treatment by radical surgery. The autopsy specimens show that in many instances the disease has had a tendency to remain localized in the pelvis, and death is usually due to uremia resulting from ureteral blockage. It is our present opinion that when there is no discernible extension of the lesion beyond the cervix and the vagina, a combined perineal and abdominal vulvectomy, vaginectomy and hysterectomy should be done. If, as in our recent case, the anterior vaginal lesion is dangerously near the urethra, the urethra should be removed with the vagina, and the bladder opening closed from below. Subrapubic drainage was done, and if the patient survives for 2 years, the possibility of an ileal loop bladder may be considered. If the lesion extends beyond the vagina and the cervix, an exenteration might be considered, but in the opinion of the author it would be hardly human to subject an infant to the handicap of diverted feces and/or urine, especially when the chances of survival are so slight.

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# Surgical Conditions of the Urethra

## URETHRAL CARUNCLE

Urethral caruncles are benign, polypoid growths presenting at the urinary meatus and usually originating from the posterior wall (Fig. 450 A). In some instances they are attached by a small pedicle; in others they are sessile. Usually they are single, but multiple caruncles arising from the same general area do occur. Because of their vascularity, they are deep red in color and often raspberry-like in appearance.

Histologically, there are 3 types: papillomatous, angiomatic and granulomatous. The papillomatous is by far the most common type. They are covered with stratified squamous or transitional epithelium and have a scanty connective tissue and vascular framework. The angiomatic are composed of dilated vessels with a small amount of connective tissue between the vessels. Since there are often abrasions of the epithelium, there is frequently polymorphonuclear or round-cell infiltration. The least common caruncles are composed of granulation tissue and are inflammatory in origin.

Urethral caruncles are often incidental findings on routine pelvic examination and are entirely asymptomatic. However, there may be pain on urination and the pain may be excruciating. We never have been able to distinguish histologically between the sensitive and the nonsensitive caruncles. A blood-tinged discharge or frank bleeding may be the complaint. There is very little difficulty at diagnosis in most instances. The tumors are soft on palpation, whereas carcinoma at the meatus is indurated and infiltrating.

Small caruncles may be entirely destroyed by monopolar fulguration (Fig. 450 B). If the caruncle is larger, the pedicle may be severed with the surgical diathermy knife, and the base is thoroughly destroyed with the desiccating current. There is often a tendency for urethral caruncles to recur, but much less tendency when they are removed as suggested above than when clipped off with the knife or the scissors. Sometimes, with recurrent caruncles, the distal portion of the urethral floor requires resection. This is done as in the resection described in this chapter

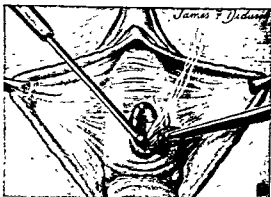
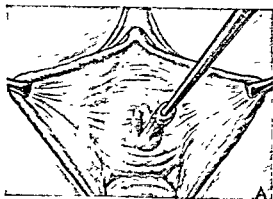


FIG. 450. Destruction of urethral caruncle with high-frequency fulguration.



for urethral prolapse, but only the inferior half of the circumference of the urethra is excised.

### URETHRAL PROLAPSE

Slight eversion of the mucosa at the urethral meatus is common and seldom gives rise to symptoms. Real prolapse of the mucosa of the urethra is rare. It is characterized by a sliding outward of the urethral mucosa through the meatus. Then it becomes cyanotic, edematous and even infarcted (Fig. 451). The symptoms vary greatly. Prolapse may cause no discomfort and only be detected when a bloody discharge occurs as the result of the breaking down of the congested tissues. Other patients complain of sudden, severe and continuous pain with frequency of urination and tenesmus.

The cause of urethral prolapse is not known. Emmet thought that during parturition the child's head pressed forward the loose tissue about the neck of the bladder and lacerated the periurethral fascia. This scarcely seems to be a likely explanation, for the cases are most prone to occur at the extremes of life. Emmet's explanation would seem to be more suitable for the formation of urethrocele. Keefe reports the age incidence as 60 per cent below 15 years; 12

per cent between 15 and 40 years; and 28 per cent over 40 years. We have observed it only in infants and elderly women. In infants it usually is preceded by a severe coughing or crying spell. Paroxysms of coughing also seem to be related to its occurrence in some of the elderly women. From the frail nature of the elderly women in whom we have seen the condition, it would seem reasonable to believe that the loss of tone and elasticity of tissues, due to age, is a factor in its formation.

The treatment may be palliative or surgical. Occasionally, the edematous mass of tissue may be reduced, but even if this maneuver is successful, recurrence is common. Hot, moist compresses give temporary comfort.

Several surgical procedures have been suggested. The procedure advocated by Kelly and Burnam is illustrated in Figure 452. The prolapsed mucosa is amputated by a circular incision, as shown in Figure 452 A. The cut edges are then sutured with No. 000 chromic catgut, as shown in Figure 452 B. Amputation with the electrosurgical knife is advantageous over excision with the scalpel.

Livermore was the first to advocate treatment of urethral prolapse with fulguration. He fulgurated the 4 points of the compass

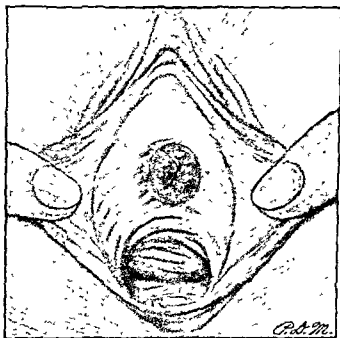


FIG. 451. Prolapsed urethra.

for a few seconds each and reported success. When the prolapse is not too marked, the scarring produced in this manner would seem to be effective, but if there is extensive prolapse with infarction, all of the prolapsed tissue must be removed or it will slough. We have destroyed all of the prolapsed tissue with the desiccating current with good results and without stricture formation at the meatus. As a matter of fact, the scarring at the meatus resulting from this is a protection against recurrence.

### CYSTS OF SKENE'S DUCTS

On rare occasions, the lumen of one of Skene's ducts may become occluded, and a retention cyst may result. The etiology of this occlusion must be inflammatory, but we have observed it in women in whom there was no suggestion of neisserian infection in the history or the physical findings. Figure 453 A shows the typical picture with the resultant deformity of the urethral meatus.

The cysts should be excised even though, when small, they may be asymptomatic. The reason for this is the fact that the larger they become, the greater will be the difficulty in dissecting the cyst from the displaced urethra, and the more danger there will be of injuring it. A glass catheter is first inserted into the urethra, and a circular incision is

made about the base of the protruding cyst (Fig. 453 B and C). With careful dissection the cyst is freed from its bed as shown in Figure 453 D, bearing in mind constantly the danger of injury to the delicate urethra. In Figure 453 E the cyst has been completely removed. The raw surfaces are approximated with No. 000 chromic catgut, any redundant mucosa is excised, and the mucosal edges are sutured together with interrupted sutures of the same fine chromic catgut (Fig. 453 F).

### SUBURETHRAL CYST

Suburethral cysts, such as the one shown in Figure 454 A, are of unknown etiology. It is unlikely that the cyst shown here arose from Skene's gland for it was exactly in the mid-line, a short distance within the vagina, and did not displace the meatus. It interfered with coitus but otherwise gave rise to no symptoms. Its excision is shown in Figure 454. Figure 454 B illustrates the vaginal mucosal elliptical incision which is designed to remove the excess vaginal mucosa. Then the wall of the cyst is deliberately incised, as shown in the dotted line in Figure 454 C. A Hegar metal dilator is placed in the urethra, in order to identify it easily at all times during the operation. Then the cyst wall is excised with sharp dissection (Fig.

*(Continued on page 793)*

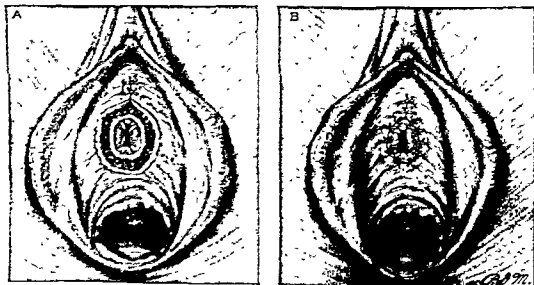


FIG. 452. Whitehead type of operation for urethral prolapse. (A) The prolapsed mucosa has been excised. (B) Completed operation.

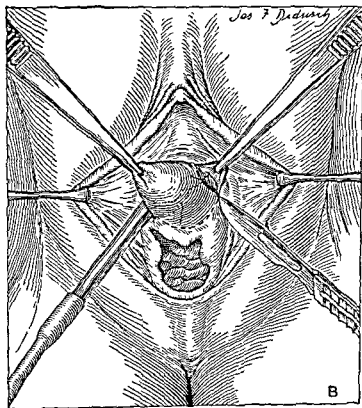
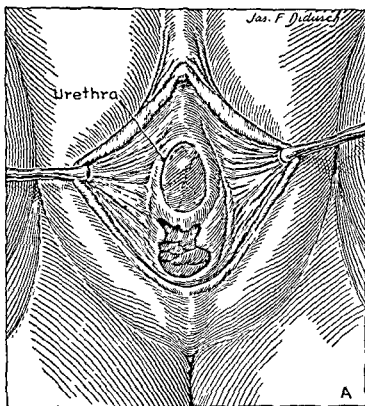


FIG. 453. Excision of Skene's cyst. (A) Shows pre-operative condition. (B) Glass catheter has been inserted in the urethra to identify it. Dotted line indicates incision encircling cyst.

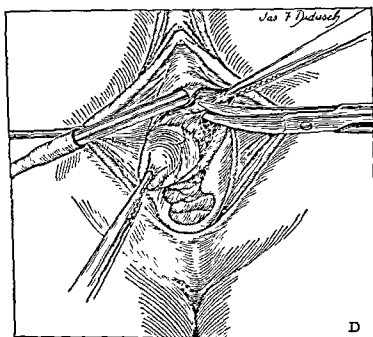
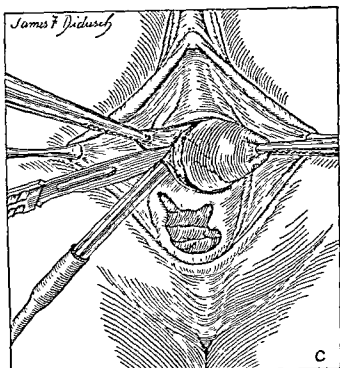


FIG. 453 (Continued). Excision of Skene's cyst. (C) The cyst is freed with sharp dissection. (D) The incision has been completed about the cyst.

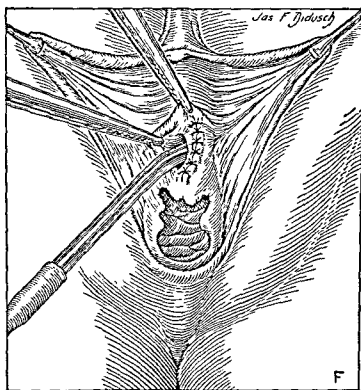
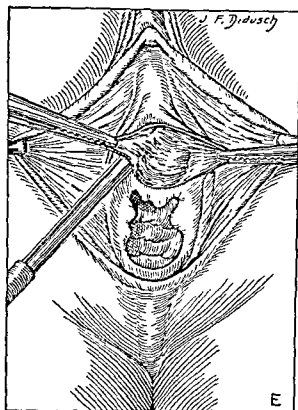


FIG. 453 (Continued). Excision of Skene's cyst. (E) The cyst has been completely removed, leaving the urethra intact. (F) The mucosa has been approximated with No. 000 chromic catgut in interrupted sutures.

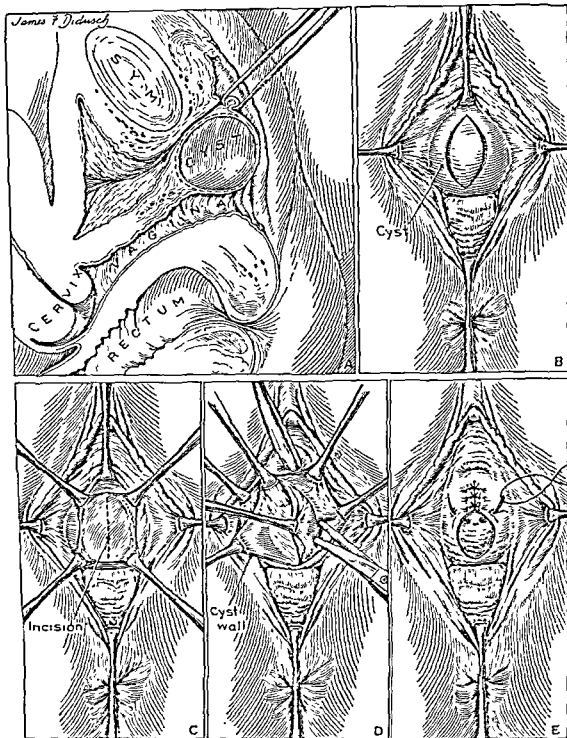


FIG. 454. Excision of a suburethral cyst. (A) Sagittal section showing relation of the cyst to the vagina and the urethra. (B) Incision is made through vaginal mucosa beneath the cyst. (C) The vaginal mucosa has been dissected from the cyst wall. The dotted line indicates the incision in the cyst wall. (D) With the cyst open, the wall is dissected free from the subjacent urethra. Note Hegar dilator in the urethra. (E) The cyst has been removed without injury to the urethra. The mucosa is being closed with interrupted sutures of fine chromic catgut. Each suture takes a bite of the subjacent periurethral tissue.

FIG. 455. Showing urethral diverticulum filled with contrast medium. The bladder is partially filled.



454 D). The vaginal mucosal incision is closed with interrupted sutures of No. 00 chromic catgut, each stitch picking up a bit of the subjacent tissue but avoiding the urethral lumen (Fig 454 E).

### DIVERTICULUM OF THE URETHRA

The subject of diverticulum of the urethra in the female is scarcely a new one, the first case having been reported in 1805 by Hey, who stated that he had treated his first case in 1786. The second case to find its way into the literature was that of Foucher in 1857. Priestley reported the third case in 1867. Lawson Tait described a case of "Saccular Dilatation of the Urethra" in 1875. The first reports were of single cases, whereas later reports of multiple cases appeared, such as that of Hunner in 1938. He stated that he had seen probably 12 to 15 cases of urethral diverticulum, including 3 with calculi in the sac.

In spite of these reports the condition has not been generally recognized by the profession, and there is no doubt that many women are unnecessarily suffering from it today, even though they have repeatedly consulted gynecologists and urologists. It seems apparent that whenever the condition is called to the attention of the profession by an article in the literature more cases are diagnosed. Then, after a lapse of time the

cases seem to be overlooked again. This point is well illustrated by our experience at the Johns Hopkins Hospital. During the 19-year period, 1931-49, 22 cases were diagnosed and treated at the Hopkins Hospital. The cases were reviewed and published by Wharton and Kearns in 1950. In the succeeding 5-year period through 1954, 41 cases were diagnosed. Since then, being more alert to the possibility and with better diagnostic methods, we are encountering urethral diverticula with increasing frequency.

They are usually small but vary in size from 3 mm. to 8 cm. in diameter. Some of the larger ones burrow along the entire length of the urethra. It is probable that the majority of these cysts begin as neisserian urethral infections which break through into the suburethral tissue and form an abscess cavity which ultimately becomes lined with epithelium. The gonococcus is seldom cultured, but this does not exclude it as the primary agent. The usual organisms cultured are *Escherichia coli*, gram-positive cocci and diphtheroids. However, the diverticulum shown in Figure 455 never had shown evidence of inflammation clinically, and the excised wall was not inflamed, as revealed by microscopic examination. The lining was epithelium, identical with that of the normal urethra. It became apparent during the patient's first pregnancy and hence could not have been the result of obstetric

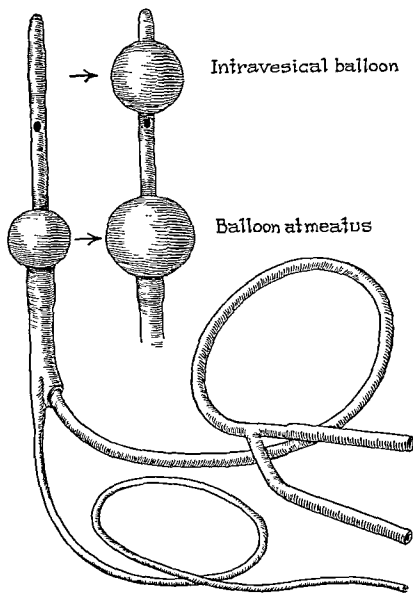


FIG. 456. Special catheter for injecting medium for urethrogram. The distal balloon is deflated, and the catheter is introduced. The proximal balloon is movable and is pressed against the meatus to trap the contrast medium in the urethra.

injury. It would seem that a congenital cause must be ascribed to such a diverticulum. Many causes have been considered to be responsible for urethral diverticula, but there is no proof of any of them. In 1941, Parmenter described 8 cases and suggested various acquired etiologies such as trauma from childbirth, infection of urethral gland with sealing off of communication with the urethra and subsequent re-establishment of communication, instrumentation of the urethra, urethral stone and urethral stricture. In addition, he considered several congenital

causes such as origin from Gartner's duct, faulty union of prima, folds, cell nests, wolffian duct and vaginal cysts that have ruptured into the urethra.

The symptomatology is variable. Among 66 cases studied by Lawrence Wharton, Jr., and Te Linde, in 44 the chief complaint was dysuria; frequency was complained of 29 times, and urgency 14 times. A lump in the vagina, intermittent discharge from the urethra, hematuria, dyspareunia and pain on walking were also complained of. Pus was found in the catheterized urine specimen in



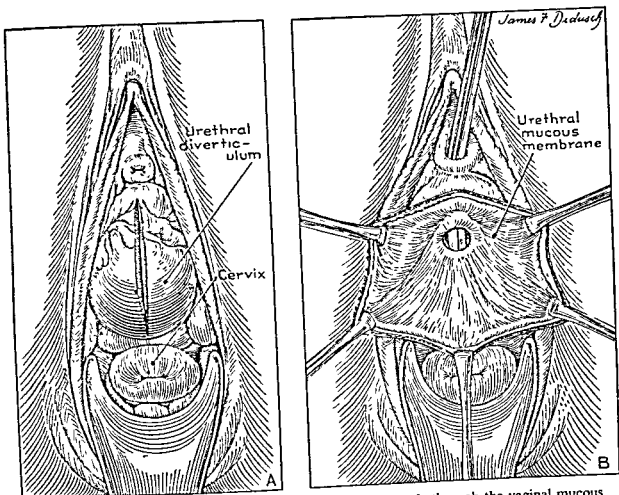


FIG. 457. Diverticulum of the urethra. (A) Incision is made through the vaginal mucous membrane and the wall of the diverticulum. (B) The diverticulum is laid wide open, demonstrating communication with the urethra.

35 cases. This would seem to be dependent upon the position of the orifice. If it is sufficiently close to the outer end of the urethra, there may be no leakage of pus back into the bladder. It is probable that this may explain the absence of symptoms of "cystitis" in a fairly large percentage of the cases. On examination of the urethra through the cystoscope, often an opening can be demonstrated, but some of the openings are extremely small, and usually there is edema due to inflammatory swelling, so visualization may be difficult or impossible. The diagnosis is usually firmly established by the demonstration of the diverticulum by roentgenograms. This is accomplished by the use of a special catheter devised by Davis and Cian and pictured in Figure 456. By its use the urethra may be blocked off at either end and distended with Salpix. Figure 455

shows a roentgenogram of a diverticulum demonstrated in this manner. The important thing to remember is the possibility of a urethral diverticulum in cases of intractable cystitis. The palpation of a suburethral mass in such cases is extremely suggestive of diverticulum. Pressure on the mass may cause the escape of urine or pus from the meatus.

The treatment consists of complete excision of the wall and closure of the defect in the urethra. Figure 457 A shows the diverticulum protruding into the vagina. Its smooth vaginal covering is seen in contrast with the rough mucosa of the rest of the vaginal wall. In order to avoid injury to the urethra, it is advisable to open into the cavity of the diverticulum. A mid-line incision is made through the vaginal mucosa and the wall of the diverticulum (Fig. 457 A). The edges of the incision are retracted,

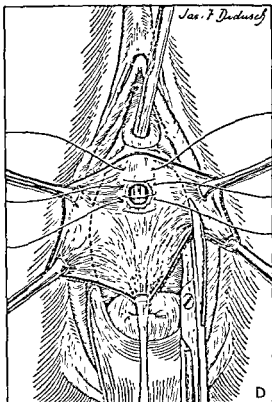
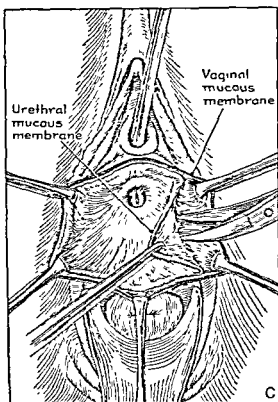
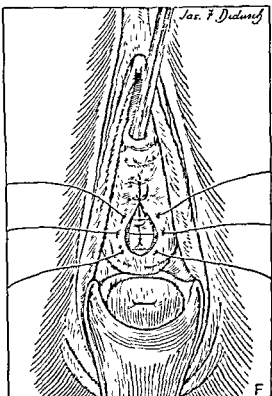
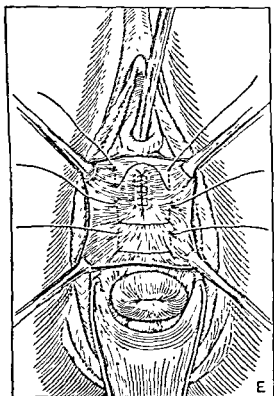


FIG. 457 (Continued). Diverticulum of the urethra. (C) The mucosa lining the diverticulum is being completely removed. (D) The communicating opening is closed with mattress sutures, and excess of vaginal mucosa is being excised. (E) First line of closure is reinforced with a second one, using interrupted mattress sutures of No. 0 chromic catgut. (F) Mucosa is closed with interrupted sutures of No. 0 chromic catgut.



and the interior of the cavity is inspected. The opening into the urethra usually is easily seen, particularly if a glass or metal urethral catheter has been passed (Fig. 457 B). Under sight, the rather thick mucosa of the diverticulum is separated from the vaginal mucosa and is trimmed off. The urethral defect is closed with interrupted mattress sutures of No. 00 chromic catgut, which invert the edge into the urethral lumen (Fig. 457 D). After trying these sutures, they are buried with another row of mattress sutures by approximating the suburethral fascia (Fig. 457 E). Finally, the vaginal mucosal incision is closed with interrupted sutures of fine chromic catgut.

An indwelling catheter is usually inserted and left in until the morning of the 5th day. The patient is allowed to go to the toilet to void and usually can. The trauma of repeated catheterizations should be avoided if possible. If the patient is unable to void for a day after removal of the catheter, it is probably better to replace the indwelling catheter for a few more days. If the diverticulum has been removed from the distal portion of the urethra so that there has been little trauma to the vesical sphincter region, we frequently omit the indwelling catheter

and permit the patient to be up to void, which she usually does from the onset.

The results of excision of urethral diverticula are usually satisfactory. Three of our 66 cases developed urethral strictures. These were delicate and easily broken down by urethral dilatation, giving permanent relief. An occasional small urethral fistula occurs which is easily repaired if it causes incontinence. In the distal part of the urethra, such a fistula gives no incontinence and need not be repaired.

### CARCINOMA OF THE URETHRA

The majority of the reported carcinomas of the female urethra arise at the urethral meatus at the junction of the transitional epithelium of the urethra and the stratified squamous epithelium of the vulva. The appearance of these tumors may suggest a caruncle, and this emphasizes the importance of biopsying all "caruncles." The remainder of urethral carcinomas arise from higher in the urethra and bring about an indurated fusiform enlargement of the organ. Recently, Brack has reported on 11 urethral carcinomas from our clinic, all of which were of the epidermoid type. This constitutes a rather large group of cases of this rare disease and

TABLE 11. CARCINOMA OF FEMALE URETHRA

CASE No.	AGE	PATH. DIAGNOSIS	CLINICAL TYPE	TREATMENT	RESULT
1	62	Epidermoid car., transitional	Vulvo-urethral	Radium, x-ray and surgery	Well 9½ yrs.
2	55	Epidermoid car., transitional	Urethral	Radium	Died of stroke 8½ yrs.
3	62	Intraepithelial car. of urethra	Vulvo-urethral	Rad. and x-ray	Died 4 yrs., chronic pyelonephritis
4	53	Epidermoid car., spinal cell	Vulvo-urethral	Rad. and x-ray	Recurrence 2½ yrs. Presumed dead
5	61	Urethral caruncle with malig. degen.	Vulvo-urethral	Rad. and x-ray	Died 2 yrs.
6	52	Epidermoid car., transitional	Urethral	Rad. and x-ray	Living and well 6½ yrs.
7	76	Carcinoma urethra	Urethral	Rad. and x-ray	Died 4 months
8	59	Epidermoid car., transitional	Vulvo-urethral	Rad. Excis. caruncle	Living and well 4 yrs.
9	62	Epidermoid car., transitional	Urethral	Rad., x-ray and surgery	Living and well 4 yrs.
10	48	Epidermoid carcinoma	Urethral	Rad. and x-ray	Died 1 yr.
11	67	? Carcinoma in polyp	Urethral	Radium	Living and well 1 yr.

TABLE 12. CARCINOMA OF FEMALE URETHRA

CASE No.	INTRA-URETHRAL RADIUM	CONTRA-URETHRAL RADIUM	X-RAY ABDOMINAL	X-RAY PERINEAL	RESULT
1	None	2,708 mgm. hrs. (2 treatments)	900 r each of 4 ports 200 kv.	1,800 r 200 kv.	Well 9½ yrs.
2	1,200 mgm. hrs. (4 treatments)	2,400 mgm. hrs. (1 treatment)	None	None	Died of stroke, 8½ yrs.
3	1,200 mgm. hrs. (4 treatments)	2,000 mgm. hrs. (2 treatments)	None	2,000 r at 200 kv.	Died 4 yrs., pyelonephr.
4	775 mgm. hrs.	1,175 mgm. hrs. (2 treatments)	2,100 r each of 2 ant. ports 400 kv.	None	Recurrence 2½ yrs. Presumed dead
5	None	1,100 mgm. hrs. (2 treatments)	2,000 r 200 kv. each of 2 large ports	None	Died 2 yrs.
6	600 mgm. hrs. (2 treatments)	None	1,000 r at 200 kv. single abdom. port	None	Well 6½ yrs.
7	None	1,600 mgm. hrs. (2 treatments)	1,600 r 400 kv. single port	None	Died 4 months
8	None	1,200 mgm. hrs. (1 treatment)	None	None	Well 4 yrs.
9	1,200 mgm. hrs. (4 treatments)	None	2,500 r each 4 fields 400 kv.	None	Well 4 yrs.
10	2,383 mgm. hrs. (2 treatments)	1,907 mgm. hrs. (2 treatments)	1,100 r each 4 fields 400 kv.	500 r 250 kv. single field	Died 1 yr.
11	900 mgm. hrs. (3 treatments)	1,188 mgm. hrs. (1 treatment)	None	None	Well 1 yr.

represents the entire experience of our clinic in recent years. The symptoms were hematuria, frequency, urgency, dysuria, difficulty in emptying the bladder and incontinence. In addition, several of the women complained of intermenstrual bleeding, which they assumed to be per vaginam.

Table 11 indicates the type of treatment given and the results to date.

Since much individual consideration must be given to each case the following Table 12 is shown to indicate methods of therapy carried out.

In addition to the individualization of irradiation therapy, surgery must be done in some cases, and Brack's conclusions, based on perhaps as great an experience as anyone in this country, follow:

We feel that irradiation is the treatment of choice in relatively early carcinoma of the female urethra where no metastases are present. Should the tumor fail to respond to this therapy, vaginal excision of the urethra and the vesical neck and bilateral transplantation of the ureters to the colon may be done following the irradiation. If the urethral carcinoma is very extensive, and particularly where there are metastases to

the inguinal lymph nodes, irradiation, in our experience, does not effect a cure. In such cases radical surgery should be resorted to if the patient is a sufficiently good operative risk. The operation should consist of total cystectomy and urethrectomy, transplantation of the ureters to the colon, and radical excision of the inguinal lymph nodes; it may be done in either 2 or 3 stages, depending on the condition of the patient.

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# Surgery of the Abdominal Wall

Although the surgery of the abdominal wall is not, strictly speaking, within the realm of gynecology, the operating gynecologist should be familiar with it. Often defects in the abdominal wall are present in women whose major lesions are in the pelvis. To take care of both conditions, when feasible, under a single anesthetic is greatly to the benefit of the patient. With this thought in mind we include in this volume a chapter on the more common abdominal-wall conditions of women.

## INGUINAL HERNIA

Every gynecologist should be familiar with inguinal hernias from the standpoint of differential diagnosis, and he should be able to repair such hernias when called upon to do so. Almost all inguinal hernias in women are indirect and congenital. They occur much less frequently than in the male for two reasons. First, the spermatic cord is larger than the round ligament, and the processus vaginalis testis is less frequently obliterated than the canal of Nuck. Nobbe states that the canal of Nuck is found in from 8 to 10 per cent of female subjects, whereas a patent processus vaginalis testis is present in from 30 to 40 per cent of males. Second, hard physical labor is less common among the female sex. One might think that the increased intra-abdominal pressure of pregnancy might predispose to inguinal hernia in the female. As a matter of fact, during the latter months of pregnancy an inguinal hernia may disappear as the enlarging uterus pulls the sac back into the peritoneal cavity. After delivery the hernia returns and sometimes is of greater size because of poorer musculature.

The problem is presented to the gynecologist for a diagnosis of a recurring swell-

ing in the inguinal region. The swelling is usually painless, but there may be a history of recurring pain. Strangulation in inguinal hernias is rare in women because the hernias are apt to be small, and because there is less straining at hard work. If the hernia is "down," one can feel a semisolid mass that is usually reducible. If reducible, the diagnosis is simple, for about the only other reducible mass that can occur in this region is varicosity of the labial veins. The wormlike appearance and the color of these veins make the diagnosis simple. If the hernia is reduced at the time of the examination, usually the external ring is easily palpable. If difficulty is encountered in locating the ring, the patient is asked to cough while standing. As the impulse is felt, the palpating finger follows the sac back through the ring.

Differentiation of inguinal hernia in women must be made from hydrocele of the canal of Nuck, lipoma, adenomyoma of the extraperitoneal portion of the round ligament, inguinal adenitis and femoral hernia. Hydrocele of the canal of Nuck is felt as a tense fluctuating tumor that cannot be forced out of the inguinal canal. The inguinal lipoma feels semisolid, is circumscribed, painless and often lobulated. Adenomyoma of the round ligament is very firm, and there may be a history of pain and tenderness at the time of the menses. Inguinal glands, when acutely inflamed, are painful and tender. Chronically infected glands may show little or no tenderness and are movable over the subjacent aponeurosis. They may be conglomerate, or several discrete glands may be felt.

The differentiation between complete inguinal hernia and femoral hernia must be made. Watson lists the following differential points:

**Complete Inguinal Hernia**

The hernia makes its exit through the external ring internal to the spine of the os pubis.

Protrusion of the hernia causes a distention of the inguinal canal.

Reduction by taxis is upward, outward and backward.

**Femoral Hernia**

The hernia is entirely external to the spine of the os pubis.

The inguinal canal is empty.

Direction of reduction is upward and backward.

**TREATMENT**

Innumerable operations for inguinal hernia have been described; many of them are only slight modifications of established procedures. The modern operative treatment of inguinal hernia consists of free exposure of the sac and the structures of the inguinal canal by open dissection and a plastic reconstruction of the layers of the abdominal wall. Real fundamental contributions to the modern operation were made by Marcy, Bassini and Halsted. In 1881 Marcy was the first to advocate high ligation of the sac, transplantation of the cord and reconstruction of the inguinal canal. He was the first to use absorbable sutures in hernia operations. In 1883 Bassini attempted to cure inguinal hernia by ligating the sac at the internal ring and stitching the stump to the posterior surface of the external oblique, using a portion of the neck of the sac as a tampon to close the inguinal canal. He soon abandoned this, and the principal features of the Bassini operation of today are: high ligation of the sac, transplantation of the cord and repair of the inguinal canal. Bassini used silk, placed his patients in plaster-of-Paris casts and kept them in bed for 6 weeks. In 1889 Halsted described his operation in which he transplanted the cord, but he later modified his technic without cord transplantation. Halsted made a special point of the utilization of the cremaster muscle and fascia. He used mattress sutures of silk. The operation used in this clinic resembles that of Halsted, but, the patients being female, cremaster muscle and cord do not enter into the operation. Since there is no cord in women, the ring and the inguinal canal can be completely closed, and

the percentage of recurrences is smaller in women than in men. We do not insist on silk, leaving that to the preference of the operator. There is no doubt that healing with silk sutures is accompanied by less reaction than when catgut is used. On the other hand, if infection does occur with silk, drainage continues until the last piece of silk is discharged from the wound.

**TECHNIC OF REPAIR IN THE FEMALE**

An oblique incision is made parallel with and about an inch above Poupart's ligament. The length of this depends on the size of the hernia, but in general it extends from a point an inch or two medially to the anterior superior spine to the symphysis pubis. The incision is carried through the fat, and the aponeurosis is cleaned of fat for about an inch above the incision and down to Poupart's ligament below.

The aponeurosis is split in the direction of the fibers about an inch above Poupart's ligament and parallel with it. This splitting of the fibers is carried down into the external ring. Thus the inguinal canal is opened, and the neck of the sac is exposed. The sac is dissected free down to the neck, separating it from the round ligament to which it is attached. The sac is opened, the contents are inspected and, if there is no strangulation, the contents are reduced into the abdominal cavity. The neck of the sac is then ligated as high as possible with a transfixion suture of No. 2 chromic catgut (Fig. 458 A).

The closure of the musculofascial wall is then begun. In closure, care should be taken to avoid the nerves in the suture. The inguinal branch of the ilio-inguinal nerve, the hypogastric branch of the iliohypogastric nerve and the genital branch of the genitocrural nerve are all within the operative field. The iliohypogastric nerve supplies motor fibers to the external and the internal oblique, the transversus abdominis and the rectus muscles. The inclusion of these nerves in the suture may bring postoperative discomfort and cause atrophy of the muscles they supply. The ilio-inguinal nerve is often found on the undersurface of the aponeurosis of the external oblique, about an inch above the external ring. The iliohypogastric,

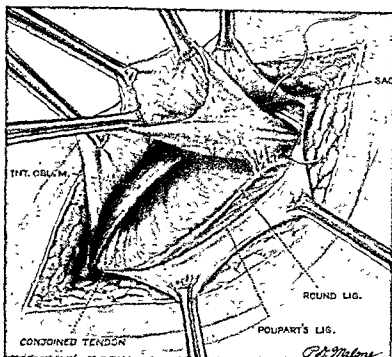
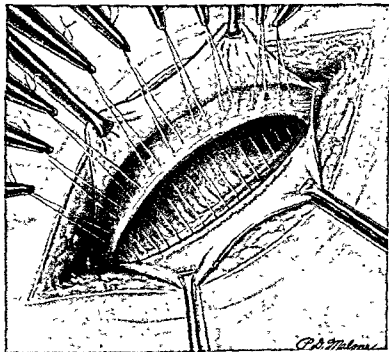


FIG. 458. Repair of inguinal hernia. (A, top) The sac has been dissected free and has been opened to make certain that it is empty. Traction is made on it, and a transfixion suture of No. 2 chromic catgut is being placed in the neck. (B, bottom) The lower edge of the transversus abdominis and the internal oblique muscles are being sutured to the undersurface of Poupart's ligament with mattress sutures.



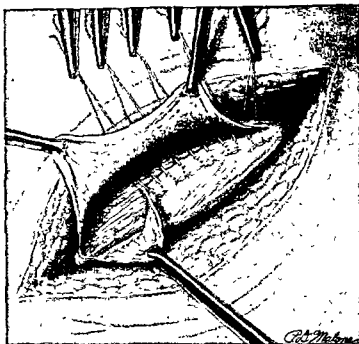
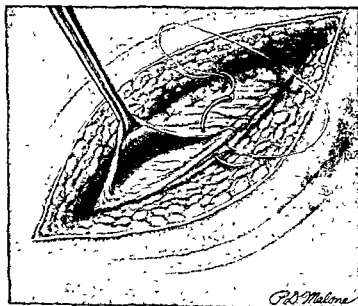


FIG. 458. (*Continued*). Repair of inguinal hernia. (C, *top*) The lower flap of the external oblique aponeurosis is sutured with mattress sutures up under the upper flap. (D, *bottom*) The upper flap of the aponeurosis of the external oblique is being sutured with a continuous suture to the outer surface of Poupart's ligament.





which lies 1 or 2 inches higher, is less liable to injury. The genital branch of the genitocrural nerve accompanies the round ligament. The lower edge of the transverse abdominis and the internal oblique is first sutured to the inside of Poupart's ligament. This is done with interrupted mattress sutures of No. 0 chromic catgut or medium silk, as the surgeon prefers (Fig. 458 B). The closure is carried down snugly to the symphysis.

The lower flap of the aponeurosis of the external oblique is then brought up under the upper flap with a series of interrupted mattress sutures (Fig. 458 C).

The lower edge of the upper flap of the aponeurosis is sutured to the outer surface of Poupart's ligament with interrupted mattress sutures or with a continuous suture as shown in Figure 458 D.

Closure of the fat with very fine catgut or silk and closure of the skin with fine silk completes the operation.

### FEMORAL HERNIA

Femoral hernias are of special interest to the gynecologist because of their frequent occurrence in women. According to Berger, femoral hernias represent 32.7 per cent of all hernias found in women, whereas only 5 to 6 per cent of hernias in men are of the femoral variety. The hernia is a protrusion of the abdominal or pelvic viscera through the femoral ring into the femoral canal or beyond.

Consideration should be given to the anatomy of the femoral region in order to consider intelligently the operative cure and to avoid injury to important structures in that region. The femoral canal is conical, with the base of the cone upward, formed by the femoral ring. The canal is about 1.25 cm. in length, and the ring is about the same diameter. In women it is apt to be wider than in men. The anterior boundary of the femoral ring is the inguinal ligament. Posteriorly, it is bounded by the pectineus fascia covering the pectineus muscle. Medially, the crescentic base of the lacunar ligament (Gimbernat's) limits the opening, and laterally lies the femoral vein, separated from the ring by a fibrous septum. The round ligament lies immediately above the anterior margin of the

ring, and the epigastric vessels are close to its upper and lateral angle. The femoral ring is closed by a somewhat condensed portion of the extraperitoneal fatty tissue called the septum femorale. This is pierced by lymphatic vessels running from the deep inguinal to the external iliac lymph glands.

The femoral hernia sac descends perpendicularly beneath Poupart's ligament and between the femoral vein and Gimbernat's ligament. It pushes before it the thin tissues of the septum femorale. Descending in the femoral canal, it reaches the fossa ovalis, covered by the thin fascia cribrosa. This is stretched by the hernial sac as it protrudes forward, covered more superficially by the fat and the skin.

In small femoral hernias the sac is usually globular, but when the hernia is large it may assume any shape. Femoral hernias, if not strangulated, are often symptomless, but because the ring is nonyielding and the medial edge (Gimbernat's ligament) is sharp, strangulation is from 8 to 10 times as common as in inguinal hernias. Also, because of the nonyielding ring gangrene occurs early. Adherent omentum is the most common content of the femoral hernia sac; it may cause a dragging pain, but not colic such as is present when a loop of intestine is strangulated. Because of the small tight ring, femoral hernias are often reduced with great difficulty.

Differentiation must be made between femoral and inguinal hernia. This is discussed on page 799. Femoral adenitis causes a swelling in the same region as femoral hernia. These glands are usually felt to be multiple and give no impulse on coughing. When acutely inflamed they, of course, are tender. A lipoma, occurring in the femoral region, also gives no impulse on coughing and can be moved and lifted up with the skin.

### TREATMENT

Because the likelihood of strangulation with femoral hernia is great, and because the operative mortality is so much greater when strangulation occurs, it is best not to defer surgery long after the hernia makes its appearance.

There are two operative approaches to femoral hernia. The femoral operation is

simpler and should be preferred when no strangulation exists. The femoral ring can be closed as well from the femoral as from the inguinal side. If the mass of omentum contained within the sac is too large to be returned to the abdomen, it may be excised.

The inguinal operation is preferred if there is strangulation because it gives a good view of the sac and its contents; the constriction is easily located and released; better inspection of the intestine is permitted and, if resection is indicated, there is ample expos-

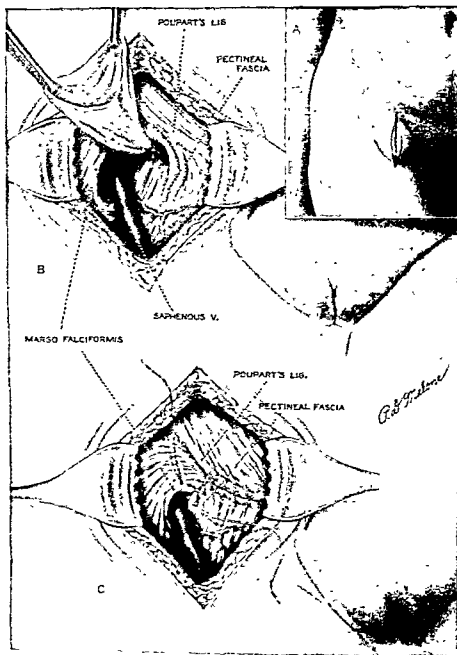


FIG. 459. Repair of femoral hernia, femoral route. (A) Indicating skin incision (B) The sac has been dissected free, opened and the contents reduced. It has been ligated at the highest possible point. (C) The femoral ring has been closed by suturing Poupart's ligament to the pectineal fascia. The margo falciformis is also sutured to the pectineal fascia.

ure. The inguinal operation has the disadvantage that it is much more of a surgical procedure and requires more time. There is danger of weakening muscles in the inguinal region, and direct inguinal hernias have been known to occur after the inguinal repair of femoral hernias.

#### TECHNIC: FEMORAL OPERATION

The skin incision is made over the femoral canal parallel with the femoral artery. It is begun just above Poupart's ligament and extends downward for 3 or 4 inches, depending on the size of the bulging sac. In making the incision, care must be exercised to prevent injuring the saphenous vein. Its position is shown in Figure 459 A. The wound is retracted, and the margo falciformis is usually visible. The sac is freed by blunt dissection up to the femoral ring. If the contents of the sac are irreducible, the usual landmarks may be difficult to recognize. It is all important to locate the femoral vessels that are retracted laterally. The sac is opened carefully, and the contents are inspected. If the sac does not appear to be constructed of thin peritoneum, the possibility of a sliding hernia of large intestine or bladder should be seriously considered. Adherent omentum is commonly found in femoral hernia sacs and often requires excision. If the sac contains irreducible strangulated bowel, a low lateral rectus incision may be made, and usually the bowel can be drawn into the peritoneal cavity by traction and taxis. If this is not possible, Gimbernat's ligament may be snipped and the intestines drawn into the abdomen. The intestines are covered with warm moist gauze while the femoral hernia is being repaired. At the end of that time the proper disposition of the strangulated bowel will be apparent. If resection is necessary, there will be adequate exposure through the right rectus incision.

The empty sac is drawn well down until the parietal peritoneum is visible. This is usually whiter and denser than the sac. The sac is transfixed as high as possible with No. 2 chromic catgut and is excised distal to the ligature (Fig. 459 B). If the neck of the sac is large, a purse-string suture is preferable to transfixion suture.

The femoral ring is then closed. If the opening is small, this may be done with a

purse-string suture that includes Poupart's ligament, the margo falciformis, the pectineus muscle and fascia, Cooper's ligament, and finally emerges again through Poupart's ligament near the point at which the original suture was taken. A curved, round-pointed needle should be used for this, rather than a cutting needle in order to reduce the possibility of injury to the femoral vein. Our usual custom is to close the ring according to Bassini's method. This is pictured in Figure 459 C. Poupart's ligament is sutured to the pectineus fascia with 3 or 4 interrupted sutures of No. 0 chromic catgut. Two or 3 similar sutures are used to suture the margo falciformis to the pectineus fascia. The subcutaneous fat is approximated with No. 0 plain catgut, and the skin is closed with fine silk.

#### TECHNIC: INGUINAL OPERATION

The patient is placed in the Trendelenburg position, which aids in the reduction of the hernia and gives a good view of the femoral ring. An incision is made about an inch above and parallel with Poupart's ligament. Such an incision usually does not need to extend as high as the incision for inguinal hernia but should extend a little lower toward the labium majus. After splitting and separating the fibers of the external oblique aponeurosis, the internal oblique muscle and the conjoined tendon are visible. The lower edge of the internal oblique and the transversus abdominis muscles are retracted upward (Fig. 460 A). The transversalis fascia is incised, and the neck of the sac is exposed. The peritoneum is opened just above the neck of the sac. By gentle traction an attempt is made to reduce the contents of the sac. If the contents are adherent, the sac may be inverted as traction is made. If the contents are not adherent, the sac may be inverted by passing a clamp into the sac, grasping its base and making traction. If the sac cannot be reduced it may be necessary to extend the incision down over the hernia and dissect the sac free from adhesions. The sac may then be opened, the contents dissected free, the omentum ligated and excised if necessary and the hernia reduced. If intestine is strangulated, it is dealt with as necessary. The neck of the sac and the peritoneum adjacent to it are freed, and after excision of

the sac the neck is closed by transfixion or purse-string suture. Closure of the femoral ring is effected from the inguinal side by suturing together Poupart's ligament, the edge of the transversalis fascia and Cooper's ligament. The innermost suture bites into Gimbernat's ligament also (Fig. 460 B). In this closure care should be taken to avoid injury to the iliac vein. Closure of the muscles and the aponeurosis is then done as for inguinal hernia.

## UMBILICAL HERNIA

Umbilical hernias are one of the commonest incidental findings in gynecologic patients. Unlike umbilical hernias in infants, which commonly are cured spontaneously or by means of a bandage, the umbilical hernias seen in adult women persist and often require treatment. Obesity and multiparity are the two great causative factors in umbilical hernias in adults. Both of these conditions increase intra-abdominal pressure, and since

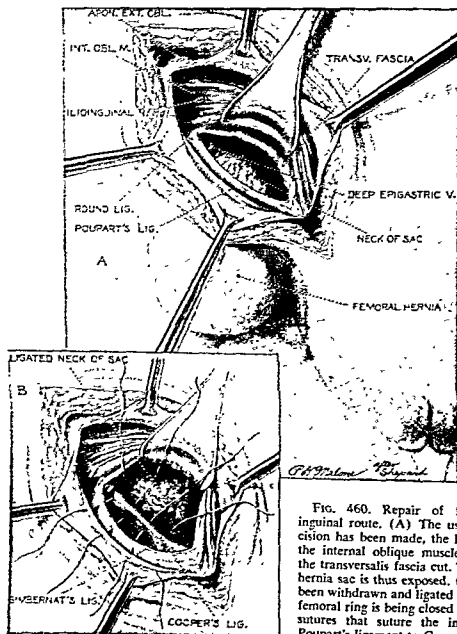


FIG. 460. Repair of femoral hernia, inguinal route. (A) The usual inguinal incision has been made, the lower margin of the internal oblique muscle retracted, and the transversalis fascia cut. The neck of the hernia sac is thus exposed. (B) The sac has been withdrawn and ligated at the neck. The femoral ring is being closed with interrupted sutures that suture the inner surface of Poupart's ligament to Cooper's ligament.

the umbilicus is one of the weak spots in the ventral wall, herniation commonly occurs there. Umbilical hernias vary in size from 1 or 2 cm. in diameter to such enormous size that they reach the knees.

Small umbilical hernias are often entirely asymptomatic. Commonly, a small protrusion is noted by the patient which may or may not be reducible. As the hernia increases in size, it is apt to produce a dull dragging discomfort. The usual contents are omentum, intestine and, rarely, other viscera. The tugging of the omentum on the intestines or the pressure of the intestines themselves within the herniating mass may give rise to indigestion and vague gastro-intestinal symptoms. Strangulation is not uncommon, and obstruction due to bands within the sac often occurs. Because the protruding mass is subject to trauma and because the folds of skin are not easily kept clean, infection of the skin is common, and the infection may extend into the contents of the sac. As a result of this, the contents may be densely adherent.

#### TREATMENT

A small asymptomatic umbilical hernia may require no treatment. The patient should be informed of its presence and told to report in case pain develops in that region. Since the incidence of intestinal obstruction in large umbilical hernias is rather high, and since the mortality of operation with obstruction is reported from 10 to 50 per cent, large umbilical hernias should be repaired. When small umbilical hernias are encountered incidentally in patients in whom laparotomy is indicated for gynecologic conditions, they should be repaired at the time of pelvic laparotomy, provided that the patient's condition warrants a little more surgery after the essential pelvic operation is completed.

With large hernias in obese women pre-operative treatment may be important. A strict diet for weight reduction is well worth while from both the patient's and the surgeon's point of view. When the skin is macerated, it should be bathed with alcohol and then covered with zinc ointment twice daily, until the skin is in excellent condition. If evidence exists that there is chronic infection deeper than the skin, the patient should

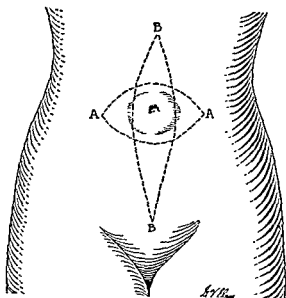


FIG. 461. Indicating types of incision used for cure of umbilical hernia. A-A is the incision for the Mayo operation. B-B is the incision made when hernia repair is combined with repair of diastasis recti or when an intra-abdominal operation is to be done at the same time.

be given a course of sulfonamide or penicillin.

#### TECHNIC: CLOSURE OF SMALL UMBILICAL HERNIA IN CONNECTION WITH PELVIC LAPAROTOMY

A vertical elliptical incision is made in the mid-line, encircling the umbilical hernia, and is carried sufficiently low to permit the necessary pelvic surgery (Fig. 461 A-B). The width of the ellipse should depend not only on the width of the hernial mass but also on the amount of panniculus desirable to be removed. The skin and the fat are dissected free from the subjacent aponeurosis. The fascia is cut in the mid-line below the hernia, exactly as in the usual pelvic laparotomy. The peritoneal cavity is entered, and the peritoneal incision is carried upward under vision through the hernial ring and a short distance above. The hernial contents are replaced in the abdomen, and the hernia sac is excised. Then the pelvic operation is done. At closure, the fascia is imbricated if it is sufficiently redundant. Mattress sutures are used to draw the first layer under the other; upper flap is sutured down with a continuous stitch of chromic catgut.

## TECHNIC: MAYO OPERATION

A transverse elliptical incision is made through the skin about the hernial mass as illustrated in Figure 461 A-A. The incision is carried down through the fat to the aponeurosis of the external oblique. The aponeurosis is cleared of fat up to the neck of the sac (Fig. 462 A). An incision is made through the fascia and the peritoneum about the neck of the sac as shown in Figure 462 A. This incision is made cautiously. As soon as the peritoneal cavity is entered, a finger is introduced into the peritoneal cavity in order to make sure that no viscera are adherent as the elliptical incision is continued around the neck of the sac. The contents of the sac, which are often adherent, are removed, inspected and replaced in the abdominal cavity. If there is a great excess of hypertrophied omentum it may be necessary to excise it.

The peritoneum and the fascia are usually adherent in this region, and no attempt is made to separate them in the closure. To facilitate closure it may be advisable to extend the elliptical incision with a transverse cut, bilaterally. The lower flap is drawn under the upper flap, the upper and the lower flaps overlapping liberally. Several interrupted mattress sutures of medium silk or No. 1 chromic catgut are used, but the sutures are not tied until all have been placed (Fig. 462 B).

The upper flap is then sutured to the lower flap with interrupted sutures as shown in Figure 462 C.

Great care should be taken for complete hemostasis, and then the fat is approximated with No. 00 chromic catgut or fine silk. The skin is closed with a continuous silk suture. If chronically infected tissue has been en-

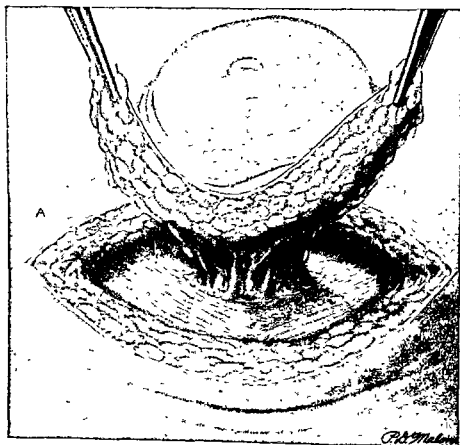


FIG. 462. Mayo operation for umbilical hernia. (A) Transverse incision has been made, and fat has been dissected from the fascia up to the neck of the hernial sac.

countered during the operation, a stab wound is made away from the skin incision, and a wick of rubber or gutta percha is inserted.

### ABDOMINAL LIPECTOMY

Lipectomy is considered in connection with umbilical hernia, because a lipectomy of some extent is always done in connection with repair of umbilical hernias in adults. When the woman is very obese, as is often the case, advantage may be taken of the her-

nia operation for the removal of a great mass of redundant skin and panniculus. Even without an umbilical hernia, a pendulous abdomen may be responsible for a heavy dragging sensation in the abdomen and also for backache. When a maximum amount of heavy panniculus is present, the patient may be greatly handicapped in her activity. Such patients are among the most grateful when relieved of this burden.

The operation for the removal of a large

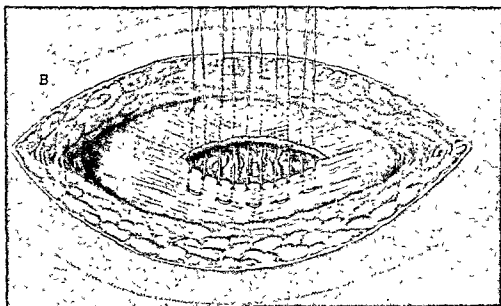
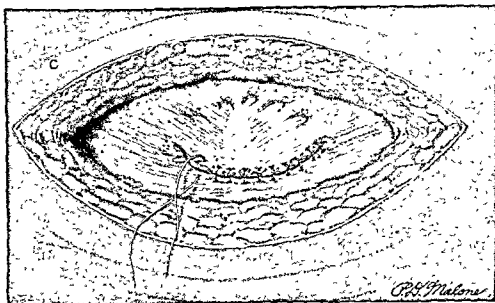


FIG. 462 (Continued). Mayo operation for umbilical hernia. (B) The sac has been excised. The lower flap of fascia is being drawn beneath the upper flap by interrupted mattress sutures. (C) The upper flap is sutured to fascia with interrupted sutures.



amount of fat from the abdominal wall is not without danger. Infection in the deep fat may be a serious complication. Scrupulous attention must be given to clearing up macerated areas on the skin, and a meticulous operative clean-up of the skin is made. Pre-operative treatment with penicillin for 1 day is advisable, and a continuation of this antibiotic for about 10 days after operation is a prophylactic step well worth carrying out. Infection in the panniculus of these obese women may be serious and always greatly retards convalescence. Pulmonary embolism may also occur. Patients on whom the operation is contemplated are often put on a reducing diet preoperatively to great advantage to the surgeon and the patient. An effort also should be made to obtain a promise from the patient that she will adhere to the diet after operation.

#### TECHNIC

When dealing with moderate obesity in connection with pelvic operations, a certain amount of skin and fat may be excised to advantage by means of a vertical elliptical incision in the mid-line. The fascia is incised along the linea alba, and the pelvic operation is performed to advantage by virtue of removal of some of the thick abdominal wall.

When there is a great pendulous panniculus the transverse "watermelon" type of incision used in the early days of our clinic by Kelly gives the best results. However, when such an incision is closed, there are apt to be unsightly projections at each end of the incision. To overcome this, half of a smaller ellipse of skin and fat may be removed at each end of the incision (Fig. 463). This point in technic is often used by plastic surgeons when excising blemishes from the skin. The alternative is to remove a gore in the mid-line superiorly and inferiorly. This has the disadvantage of cutting the skin at sharp angles, thus running the danger of slough. Hemostasis should be attended to with special care because a hematoma in such an extensive incision would interfere seriously with healing. Careful attention should also be paid to approximating the fat with fine catgut sutures to obliterate all dead space. A small Penrose drain placed at each lateral angle of the incision and left in place from 48 to 72

hours can do no harm and may be advantageous in permitting the escape of serum that could act as a culture medium for pathogenic organisms. The skin is closed with fine silk.

#### INCISIONAL HERNIA

Incisional hernias in gynecology are less frequent today than formerly for two prin-

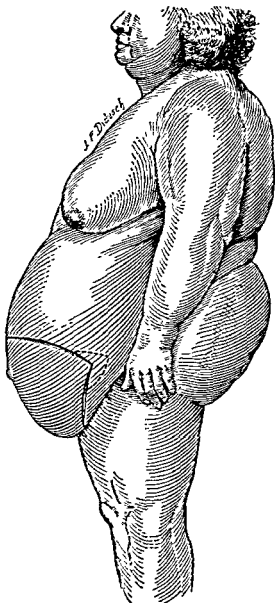


FIG. 463. Indicating incision for abdominal lipectomy. The dotted line outlines the secondary incision which prevents dog ears at either end of the closed transverse incision.



cial reasons: (1) the catgut is of much better quality than was manufactured formerly; (2) abdominal drainage through mid-line incisions is less frequent today than in the early days of abdominal surgery. Several factors are responsible for this decrease in drainage. Less operating is being done on acute and subacute salpingitis. Less drainage is done even when pus is encountered, the operator depending on antibiotics to take care of the infection. When abdominal drainage is necessary it is usually done through stab wounds, and the mid-line incision is closed tightly. Small incisional hernias frequently require no surgical repair, the patient being quite comfortable while wearing her usual foundation garment. Larger incisional hernias seldom are the cause of strangulation of the bowel because of the large opening into the abdominal cavity. On rare occasions, intestinal obstruction does occur, either from strangulation or from adhesive bands within the hernia, and such a hernia requires immediate surgical attention. Other large hernias may cause considerable dragging discomfort and may require surgical cure for relief of this, as well as for cosmetic reasons.

The diagnosis of postoperative hernia is usually easy. An uneven protrusion is seen in the region of an old laparotomy scar. When the patient coughs, an impulse is felt on palpating over the hernia region. If the hernia is reducible, the fascial edges of the hernial ring can be felt easily when the abdominal wall is made tense as the patient raises her head. There is often localized tenderness. When the hernia is irreducible, the exact position of the fascial defect may not be discoverable except at operation. Multiple hernial rings are often found when the hernial mass is dissected out.

#### TECHNIC OF REPAIR

Since in most postoperative hernias there is an excess of skin, an elliptical incision is usually made. Generally, this incision is most conveniently made longitudinally as shown in Figure 464 A; occasionally, it may be made to advantage transversely. The skin and the subcutaneous fat are dissected away cleanly, exposing the fascia and the bulging peritoneal sac.

The peritoneum is opened carefully, since

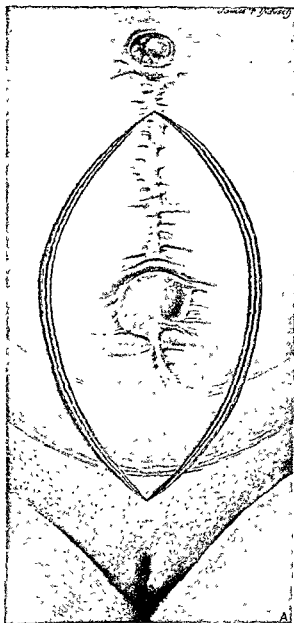


FIG. 464. Repair of incisional hernia.  
(A) An elliptical excision is made about the area of herniation.

omentum and bowel are frequently adherent. The contents of the sac are replaced into the abdomen after careful inspection of the intestines and separation of such interintestinal adhesions as seem necessary. Excessive peritoneum is excised, and the opening is closed in the most convenient manner. In Figure 464 B the lower portion of the peritoneum is closed with a continuous suture of No. 2 plain catgut, and the upper circular defect is closed with mattress sutures of No. 1 chromic catgut. Fortunately, the peritoneum is suffi-

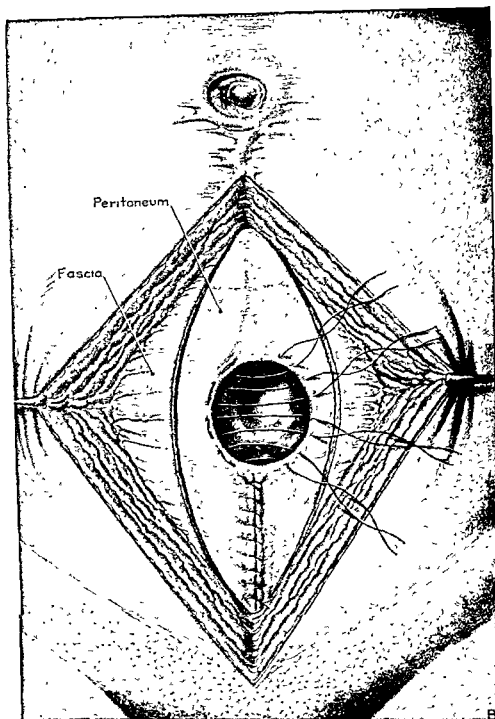


FIG. 464 (*Continued*). Repair of incisional hernia. (B) The lower portion of the peritoneum has been opened for performing a pelvic operation. It has been closed with a continuous suture of No. 2 plain catgut. The circular hernial peritoneal defect is closed with mattress sutures of No. 1 chromic catgut.

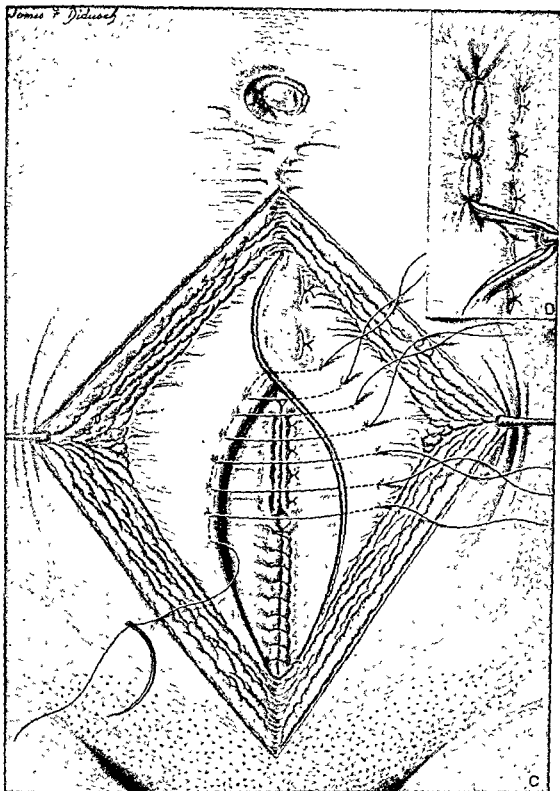


FIG. 464 (Continued). Repair of incisional hernia. (C) The right-sided flap of fascia is being drawn beneath the left-sided flap with mattress sutures. (D) The left-sided flap is being sutured to the subjacent fascia with interrupted sutures, thus completing the double-breasted closure.

ciently thickened to make closure by mattress sutures under some tension possible.

The fascia, which previously has been cleaned of fat and its edges trimmed, is closed in a double-breasted manner, overlapping the fascia as much as possible without excessive tension (Fig. 464 C). If satisfactory closure without tension cannot be effected, relaxing incisions may be made through the fascia laterally. No trouble has been noted subsequently from the defects resulting from these incisions. The double-breasted closure is effected, first, by a series of mattress sutures, several of which are placed before tying (Fig. 464 C). The loose flap is sutured down to the subjacent fascia, either by interrupted or continuous sutures (Fig. 464 D).

No. 1 chromic catgut or medium silk may be used for the fascia closure, depending on the preference of the surgeon. Silk has the advantage of giving little reaction to the surrounding tissues but has the disadvantage of acting as a foreign body in case of infection. When infection takes place in the presence of silk, drainage continues until all of the silk stitches of the infected area have sloughed out. This may be a matter of weeks or even months.

The fat and the skin are closed as in the usual mid-line incision.

The patient is kept in bed for 2 weeks before being allowed up with limited activity.

#### TANTALUM MESH IN THE REPAIR OF INCISIONAL HERNIAS

In many instances ventral hernias may be closed simply and permanently with strong fascia, as in the case pictured in Figure 464. However, the great number of recurrences seen after attempted repairs indicates that the tissues available for repairing the defect are often of such poor quality that they soon prove to be inadequate to close the defect permanently. The pioneer work of Koontz has shown that tantalum mesh is of the greatest value in such cases.

Tantalum is a rare metal, apparently entirely inert and causing no unfavorable reaction in tissues. Koontz's early experimental work consisted in producing artificial defects in the abdominal walls of animals and repairing them with tantalum mesh. Examination of these animals later showed the

abdominal walls to be very strong and the mesh to be infiltrated heavily with fibrous tissue, forming a strong closure. There was no evidence of unfavorable reaction of the tantalum on the tissues. Later experiments were done in which animal wounds were purposely infected, and although great amounts of pus drained from the wounds, they ultimately healed without sinus formation, leaving a strong closure. When silk or cotton was used with the tantalum, persistent sinuses resulted.

The tantalum mesh may be used to reinforce the closure when the fasciae used to close the defect are obviously not strong enough to ensure a permanent cure. It may also be used to close a defect when it is impossible to approximate the fascial edges. By using tantalum mesh extremely large and difficult hernias may be cured which even the bravest surgeon would not be foolhardy enough to attempt without this aid. The mesh has been used by Koontz when there has been a great loss of peritoneum, making it necessary to lay the mesh directly over the bowel. Healing was satisfactory, and the patient remained perfectly comfortable. Following the above-mentioned animal experiments, Koontz has also used the mesh in the presence of abscess in the hernial wall. Healing ultimately was perfectly satisfactory without sinus formation. In 2 cases there was an extensive slough of skin, leaving the mesh exposed. Granulations grew through the mesh, and ultimately they were covered with skin.

From the above experiments it is obvious that tantalum mesh may be used successfully under very unfavorable surgical circumstances.

**Technic.** The hernia is closed as completely as possible with the available fascia. In the case illustrated in Figure 465 there were 3 distinct hernial rings. All of them could be closed, but the fascia was too weak to give one much confidence in its ultimate ability to cure the hernia. Already there had been one unsuccessful attempt at closure of this hernia. A tantalum mesh gauze is cut to cover the whole area of questionable fascia, including the suture lines. The edge of the mesh is turned under so as to double the mesh through which the sutures are taken.

The mesh is sutured with sufficient stitches of fine tantalum wire to hold it in place. When an extensive dissection of flaps is made it is well to make stab wounds in the dependent areas of the dissected flaps and insert Penrose drains to permit the escape of fluid. The drains are usually left in place for about 48 hours.

### DIASTASIS RECTI

Diastasis of the rectus muscles is a very common finding in the routine examination of parous women. A moderate degree of the condition seldom is responsible for symptoms sufficiently pronounced to justify surgery. When the defect between the muscles is very marked, the protrusion may be as

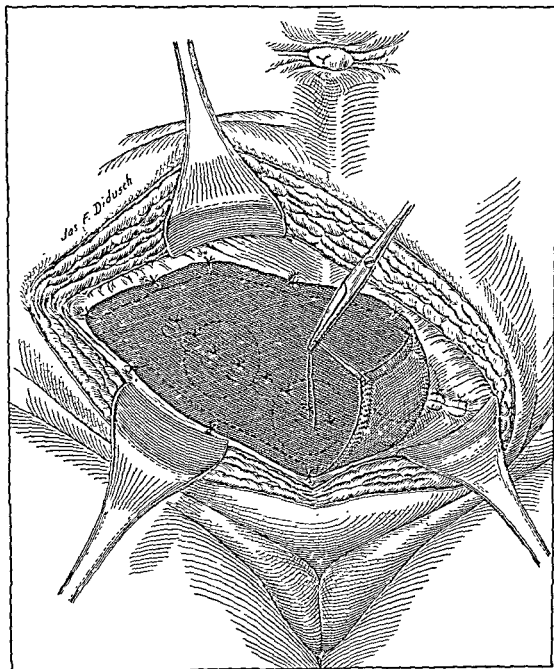
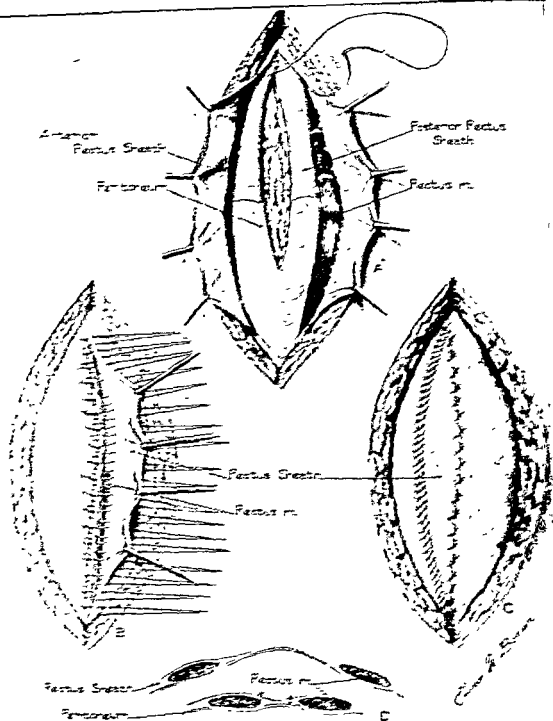


FIG. 465. Demonstrating method of using tantalum mesh to reinforce tissues in closure of hernia not curable by using patient's fascia. The circles show the position of the original hernia rings. The interrupted sutures indicate the first suture line, which was inadequate for cure of hernia.



great an annoyance as a ventral hernia. Not infrequently a certain degree of diastasis is present in patients requiring surgery for some intra-abdominal condition, and the repair of the diastasis may be done to advantage, incidental to the intra-abdominal operation.

#### TECHNIC OF REPAIR

When there is an excess of flaccid skin and panniculus, it may be excised, using a longitudinal elliptical incision. If no excess fat and skin are to be removed, a mid-line incision is made. Since the diastasis extends for the full length of the muscles this incision must be long, and it is a good plan to excise the umbilicus. The fascia is then cut for the full length of the incision, and finally the peritoneum and the posterior sheath of the rectus are incised for the same distance. The peritoneum and the posterior sheath of the rectus are closed, using a continuous suture of No. 2 plain catgut (Fig. 466 A).

The anterior rectus sheath is dissected laterally, until the edges of the rectus muscles are exposed. If there is a great excess of fascia, it may be trimmed to the desired width, permitting sufficient to remain for a liberal overlapping. Using interrupted mattress sutures of No. 1 chromic catgut or medium silk, according to the preference of the surgeon, one flap is drawn under the other so that its edge is at the border of the rectus muscle, if this is possible without too much tension (Fig. 466 B).

After tying these mattress sutures, the other flap is sutured to the fascia sheath, using a continuous suture of No. 1 chromic catgut or medium silk (Fig. 466 C). In this operation, the rectus muscles are drawn together, and the intervening fascia, which is often somewhat attenuated, is strengthened by imbrication (Fig. 466 D).

The subcuticular fat is approximated with No. 000 chromic catgut or fine silk, and the skin is closed according to the preference of the operator.

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# Appendicitis

## THE VERMIFORM APPENDIX IN RELATION TO GYNECOLOGY

The appendix, lying in close proximity to the pelvic viscera, plays an important, although often undiscerned, role in gynecology. Acute inflammation of the appendix commonly extends to the right adnexa and less frequently involves the left. Nather has reported 9 abscesses resulting from appendicitis on the left side of the lower abdomen. Faulkner has reported 3 cases of young women with inflammatory masses in the left side of the pelvis, all directly traceable to previous attacks of appendicitis. In all 3, the major pelvic lesion occurred on the left side with minor involvement of the right adnexa. The history and the intact hymen left no doubt that inflammation of the appendix, rather than primary salpingitis, was responsible for the lesion in each case. When appendiceal rupture takes place, bilateral tubal involvement is common, and complete or partial tubal closure may ultimately result. Accordingly, sterility or tubal pregnancy may be the final sequela. However, it should be remembered that the inflammation is peritubal, and in many cases, even when a large appendiceal abscess forms in the pelvis, the tubal lumina may be left intact.

The involvement of the appendix in an inflammatory process, secondary to tubal disease, is one of the commonest pathologic conditions in gynecology. Periappendicitis is diagnosed almost daily in our laboratory following the routine removal of the appendix with diseased tubes. Appendices which are so inflamed never go on to rupture or gangrene and never present a clinical problem analogous to primary appendicitis.

The differential diagnosis between acute appendicitis and acute salpingitis is one of the most frequent that the gynecologist is

called upon to make. It is also a serious one, and a mistake may be fatal to the patient. For a discussion of the differential diagnostic points, the reader is referred to the section on acute salpingitis. However, in passing, we would like to say that we have found culdoscopy of considerable value in making a differential diagnosis; on several occasions it has prevented laparotomy.

In spite of the best surgical judgment there will be occasions in which the differentiation is doubtful. In such cases it is better to remove the appendix when there is serious suspicion of its involvement. It is our custom to do this through a muscle-splitting, grid-iron incision. If the case proves to be one of salpingitis, the operator may remove the appendix without any untoward effect upon the course of the salpingitis.

The question of the practice of removing the appendix during pelvic laparotomies, more or less routinely, has long been debated among gynecologists. Since the establishment of our clinic, it has been our custom to remove the appendix in all pelvic laparotomies, except in those cases in which it appears inadvisable to prolong the operation. For many years Curtis voiced opposition to this on the basis of "increased morbidity, some increased mortality in relatively serious cases and a rather too frequent incidence of chronic postoperative discomfort in the region of the appendectomy."

As late as 1956 McCall and Bolton voiced opposition to the routine removal of the appendix during gynecologic laparotomies. They "do not consider prophylactic appendectomy justified, except when the appendix is diseased and adherent, or when the disease in the pelvis has been caused by appendicitis.

Our own experience has not brought us into agreement with this point of view. If



judgment is exercised in omitting appendectomy in the seriously ill patients, we have noted none of the above untoward effects, except perhaps for a slightly increased postoperative right lower quadrant discomfort.

Powell *et al.* operated on two comparable series of patients, with and without appendectomy. Incidental appendectomy was not found to influence the morbidity, intestinal obstruction, or the hospital stay, even when done with the presence of blood in the peritoneal cavity.

Our views on the advisability of removing the appendix whenever the opportunity presents itself with the abdomen open are confirmed when, at occasional intervals, we encounter acutely inflamed or even ruptured appendices in women who have had pelvic laparotomies. It is important always to inform the patient during her convalescence whether or not her appendix was removed.

Until recently the removal of the appendix incidentally at cesarean section was considered to be ill-advised. Larsson was one of the first to advocate it in 1954, and her publication giving her favorable experience in 20 cases stimulated new interest in this procedure. In 1959 Sweeney of Cornell undertook a deliberate study, comparing the results in 230 sections on whom appendectomy was done with 230 without appendectomy. He found the operating time to have been increased by 16.8 minutes by added appendectomy, but this did not seem to add to the operative risk or increase the hazard to the patient. There was no difference in the length of hospitalization in the 2 groups, and no difference in morbidity. Upon histologic study of the appendices, 2 were found to be acutely inflamed and 2 carcinoid. In a recent study at the Mayo Clinic Pratt *et al.* report that in approximately one half of 373 patients undergoing abdominal hysterectomies a prophylactic appendectomy was done. It caused no increase in morbidity.

#### TREATMENT OF ACUTE APPENDICITIS

There is general agreement among surgeons that the treatment of acute appendicitis in the nonperforated stage is immediate appendectomy. Clinical experience and innumerable reports on mortality clearly show

the advantage of early operation. The combined statistics of 4 University Hospitals (Minnesota, Iowa, Michigan and Vanderbilt) confirm this generally recognized point of view.

STAGE OF DISEASE	MORTALITY, PER CENT
Simple acute appendicitis . . . . .	0.49
Appendiceal abscess . . . . .	6.3
Local peritonitis . . . . .	7.7
Generalized peritonitis . . . . .	41.2

Thus there is no controversy concerning the treatment of the appendicitis *per se*, but there is considerable difference of opinion concerning the treatment of the two principal complications, namely, peritonitis and abscess. It has been the rule on both the general surgical and the gynecologic services at the Johns Hopkins Hospital to perform immediate operation when the diagnosis is made, regardless of the stage of the disease. At the present time we still believe in this as a general policy, with very rare exceptions that will be discussed later. In order to decide whether or not we are justified in continuing in the policy of immediate operation, irrespective of the stage of the disease, it might be well to look over the results of past years. In 1940 Stafford and Sprong reported on a series of 1,317 consecutive cases of acute appendicitis, in all of which the condition was treated by immediate operation. There were no deaths in the 838 cases in which perforation had not occurred. There were 479 cases in which perforation had occurred with resulting abscess or peritonitis. The mortality rate in this group was 10 per cent. A study of the fatalities led the authors to conclude that some of these deaths could have been prevented by more careful diagnosis and better treatment postoperatively. However, the mortality rate in this series is lower than the average reported for delayed or expectant treatment of perforative appendicitis.

It is only fair to consider the views of those who advocate "waiting" in those cases in which rupture is diagnosed. In the first place, it becomes obvious that there is not perfect unanimity of opinion among this group. Some would operate immediately when evidence of rupture exists, provided that the peritoneal infection is limited to the

region of the appendix. They would not operate when they find no evidence of diffuse peritonitis. Others would not operate when there is evidence of localized peritonitis but would when generalized peritonitis has developed. Some of the conservative group would not operate on palpable, well-walled-off appendiceal abscesses. Others, who would not operate when there is generalized peritonitis, would operate on these abscesses with or without removal of the appendix. If the abscess is drained without removal of the appendix, most surgeons are agreed that the appendix should be removed later.

Harvey Stone has challenged the plan of "waiting" in acute ruptured appendicitis. To the author his first objection seems to be a very effective one, namely, the impossibility of recognizing exactly the extent of the lesion from clinical signs. How frequently an unruptured, partially gangrenous appendix is removed when the clinical and laboratory data strongly suggested rupture! To permit such an appendix to remain in the abdomen would greatly jeopardize the patient's chances of recovery. Such a mistake in judging the extent of the lesion is possible by the best of surgeons, and as long as that possibility exists there is danger in the "waiting" treatment of appendicitis.

Stone further points out the great objection to the teaching of delay in certain complications of appendicitis in its effect on the general profession and public. For many years there has been effective teaching of the public to recognize the symptoms of appendicitis, and as a result many cases have gone into the proper surgical hands early in the course of the disease. If the public becomes aware of the fact that certain surgeons are "waiting" before operating they, too, will attempt the "waiting" treatment at home. This can result only in an increased mortality.

After examining the statistics on the mortality of appendicitis, obviously it is useless to attempt to prove by statistics the superiority of the details of one type of treatment over another. Therefore, we have given in this section only the combined statistics of 4 universities which prove the generally recognized point that there is a great increase

in mortality when appendicitis becomes complicated by rupture. In addition, we have given statistics from our own general surgical service to show that, in general, the immediate operative treatment results in a mortality of only 0.49 per cent. To enter into a detailed analysis and comparison of these statistics with others would accomplish nothing. Stone points out that too many factors enter into statistics in different localities to permit them to be compared. He calls attention to the fact that the surgeon who receives many cases from considerable distance will be impressed by the fact that many of the late cases will recover, but these may be the hardy survivors, whereas the patients of that locality with less native resistance may have died without the opportunity of seeing a surgeon. Stone points out how unfair it is to compare the statistics from a surgeon operating under such conditions with the statistics from a city surgeon who practices in an intelligent community whose health is cared for by the best of practitioners.

On the gynecologic service of the Johns Hopkins Hospital our general rule as to operate immediately through a McBurney incision in all cases of acute appendicitis, regardless of the stage of the disease. There is only one rare exception to this rule. Occasionally, one encounters a well-walled-off abscess that is palpable abdominally in a patient whose history suggests strongly that she is improving. It is apparent from her history that she is not as ill as she was previously and that the walled-off abscess is subsiding. Such a patient should be kept under close observation, and operation be deferred as long as improvement continues. While watching the patient, she should have the advantage of intensive antibiotic therapy. If there is evidence of spread of infection, or if the patient's general condition becomes worse, surgical intervention is carried out immediately. Our reason for making this exception to the rule of immediate operation is the experience of the author in observing a few cases that fell into this category; in those instances the patients were operated upon and died of obstruction and/or peritonitis. In retrospect, it appears

that such patients would have continued to improve if surgical intervention had been omitted at that stage.

When appendiceal abscesses are operated upon, it is our custom to make a gridiron incision directly over the abscess. The abscess cavity is entered with the greatest of care to prevent breaking up of the adhesions that are responsible for the walling-off of the abscess. If the appendix can be removed readily without danger of injury to the bowel wall or of dissemination of the infection, appendectomy is done; if appendectomy is not feasible, the abscess is simply drained. Intensive antibiotic therapy is begun. When the abscess localizes in the cul-de-sac, it is drained by colpotomy; two cigarette drains are placed in the cavity. Generally, we get the patient back in the hospital and perform an appendectomy 6 or 8 weeks after the abscess has ceased to drain. However, this is not an invariable rule. If there has been more than the one attack of appendicitis, certainly the appendix should be removed. On the other hand, if no attacks preceded the rupture, and if the patient has felt perfectly well following the drainage of the abscess, we believe that she may safely avoid an appendectomy, provided that she is warned of the necessity of surgery on the slightest evidence of trouble in that region and that she remains in a community where immediate surgical help is available.

Perhaps the term "immediate operation" should be defined. In the usual case of ruptured appendicitis it means that the operation is done as soon as the operating room can be made ready. On the other hand, very ill patients with abscess or generalized peritonitis are often dehydrated, the blood chlorides may be low, gastric and intestinal distention is marked, and there may be circulatory collapse. Often conservative treatment for a few hours greatly improves the patient's condition and enhances her chances of recovery after operation. Such patients are admitted to the ward and placed in Fowler's position. A duodenal or Miller-Abbott tube is passed, and suction is started. Five per cent glucose in normal saline solution is administered and continued during and after the operation.

Postoperatively, supportive treatment is continued in the ill patients. All food and fluids by mouth are forbidden. Suction is continued until distention has disappeared and there is evidence of intestinal activity. Saline and glucose are continued intravenously. An oxygen tent contributes to the patient's comfort and aids the circulatory effort. Intensive antibiotic therapy is continued until the patient is well on her way to recovery.

## APPENDICITIS IN PREGNANCY

Acute appendicitis occurring during pregnancy is a serious condition from the standpoint of the mother and the fetus. Fortunately, the combination of acute appendicitis and pregnancy is not common. Baer, Reis and Arens found only 28 cases in 16,543 deliveries, an incidence in pregnancy of 0.17 per cent. Cosgrove found 18 acute cases in 25,000 live births at the Margaret Hague Maternity Hospital, an incidence of 0.072 per cent. Meiling reported 1 case to 1,910 deliveries. A more recent study from the Chicago Lying-In Hospital revealed an incidence of 0.069 per cent among 59,403 women delivered in that institution.

It is the universal consensus that the disease is more serious in the pregnant than in the nonpregnant woman. Baer and his colleagues found rupture  $3\frac{1}{2}$  times more frequent than in nonpregnant women and gangrene  $5\frac{1}{2}$  times more frequent. In Ribeiro's series 15 per cent were associated with complications in the first trimester of pregnancy, and 70 per cent of the cases occurring in the last month were complicated. It becomes apparent from these statistics that generally operation is done later in the course of the disease when pregnancy exists, and that the further pregnancy is advanced, the greater the chance of complications. The mortality of acute appendicitis in pregnancy is greater than in the nonpregnant. This is due to delay in diagnosis; it is doubtful that the mortality would be greater if these women were operated on as early as the nonpregnant. McDonald, for example, reports a mortality of 0.71 per cent in the cases in which the disease is limited to the appendix; 23.5 per cent for abscess; and 30 per cent for perito-

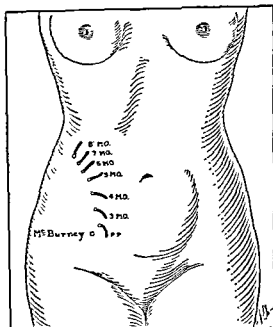


FIG. 467. Showing change of position of appendix during pregnancy. (After Baer, Reis and Arens)

nitis. Meiling reports a maternal mortality among 26 cases of all stages of 7.7 per cent. Because so many of the cases fall into the complicated groups the mortality exceeds that of the nonpregnant.

As might be expected, the incidence of abortion increases with the advance of the disease. McDonald, for example, reports an incidence of abortion of 11.4 per cent in those cases in which the disease is limited to the appendix; an incidence of 66 per cent when there is abscess; and 72 per cent with peritonitis. Meiling reports an incidence of abortion of 26.1 per cent. In addition, there was a fetal and neonatal mortality rate of 34.9 per cent, including the abortions. The mortality rate is highest among those that abort, but this is to be expected, since abortion occurs in those that are most seriously ill from the disease.

It becomes clear, then, that the mortality of appendicitis that complicates pregnancy is the mortality of delayed treatment, and delayed treatment is due to difficulties in diagnosis in the pregnant woman. Today all are agreed that surgery is indicated for appendicitis as soon as the diagnosis is made. Several factors enter into the difficulty of diagnosis.

The symptoms of nausea and vomiting, being common to both pregnancy and appendicitis, are apt to be regarded lightly and passed without an abdominal examination. To some degree the same may be said of abdominal pain. Abdominal discomfort is common during pregnancy; often it is assumed, without a careful examination, to be of little significance. The change in position of the appendix during pregnancy makes the interpretation of abdominal pain and tenderness more difficult than in the nonpregnant woman. One can interpret pain and tenderness much more intelligently if one bears in mind the change in position of the appendix during the course of pregnancy. Baer, Reis and Arens studied 70 women with normal appendices roentgenologically at regular intervals throughout pregnancy and the puerperium. They showed that the appendix undergoes progressive displacement upward after the 3rd month, reaching the level of the iliac crest at the end of the 6th month. After the 7th month of pregnancy, in 88 per cent of their cases the appendix was found above the crest of the ileum (Fig. 467). However, in interpreting these findings in relation to abdominal pain and tenderness, one must remember that in dealing with the abnormal appendix, in which previous attacks of appendicitis are frequent, there may be adhesions that fix it in a low position and do not permit its physiologic upward displacement. On the whole, it was found by Baer and his co-workers that in their cases of appendicitis the point of maximum tenderness became higher as the pregnancy progressed to term. Since some leukocytosis is the rule during pregnancy, a moderate elevation of the white count does not have the significance that it does in the nonpregnant woman in whom appendicitis is suspected. All of the above factors tend to make the diagnosis of appendicitis more difficult during pregnancy; hence, a tendency to delay operation is common. The important thing to bear in mind is the possibility of appendicitis, remembering that the symptoms of acute appendicitis are the same in the pregnant as in the nonpregnant woman. Priddle and Hesseltine, for example, found typical right lower quadrant pain in 65 per cent of the cases. This is a lower percentage than

in nonpregnant patients but significantly high to be of diagnostic importance. As right-sided pyelitis is a frequent complication of pregnancy, it is often assumed to be the explanation of right-sided abdominal pain and fever. No time should be lost in getting a catheterized specimen of urine to establish or to rule out this diagnosis. Although a completely blocked ureter may be responsible for the lack of pus in a rare case of pyelitis, a clear urine should make one extremely suspicious of appendicitis.

### TREATMENT

Immediate operation is the treatment for acute appendicitis in pregnancy, regardless of the duration of the pregnancy or the stage of the disease. Antibiotic therapy should be instituted as soon as the patient comes under observation. Because of the seriousness of acute appendicitis late in pregnancy, the problem of the proper procedures sometimes arises when a woman who has a definite history of recurrent appendicitis plans pregnancy. Prophylactic appendectomy may be advisable before pregnancy. Also, if such an individual has any suspicious discomfort in the right lower quadrant during early pregnancy, appendectomy should be done at once.

If the pregnancy is 3 months or less in duration, the appendix may be removed through the usual gridiron incision. After that time a high gridiron or a right rectus incision that may be enlarged upward or downward facilitates the removal of a displaced appendix. The further advanced the pregnancy, the higher should be the incision (Fig. 467). It is our opinion that the pregnancy should be left undisturbed, regardless of the stage. Mason and Cocke, Wilson and some other authors, do not agree with this view when dealing with appendicitis very late in pregnancy. Mason and Cocke believe that if the patient is multiparous and the obstetrician is sure that he can accomplish delivery promptly by accouchement force, this should be done. They further assert that, if the patient is a primipara, or if there is any doubt about immediate delivery in a multipara, cesarean section with appendectomy should be done. Wilson suggests that, if the appendix is unruptured, an appendectomy should be done and the abdomen

closed. If there is evidence of limited peritonitis, he advocates a low cesarean section. If the peritonitis is widespread with marked involvement of the uterine wall, he suggests the Porro operation. We do not subscribe to these views. It is our opinion, when dealing with an acutely inflamed appendix during pregnancy, regardless of the stage, that the removal of the appendix with the least possible amount of surgery is the safest, and the chances for spread of the infection are minimized. When there is evidence of peritonitis, antibiotic therapy should be intensified.

### APPENDICITIS DURING THE PUERPERIUM

The symptoms of appendicitis occurring during the puerperium may be confused by the symptom-complex incident to recent childbirth. Pains in the lower abdomen during the first 2 days of the puerperium may be considered as "after pains." Tenderness in the lower abdomen is common during the early puerperium, and its significance is apt to be misinterpreted. When there is an elevation of temperature, one is more apt to think of puerperal infection and pyelitis than appendicitis. The important thing is to bear in mind the possibility of appendicitis and palpate carefully for localized tenderness in McBurney's region. Immediate appendectomy should be done when the diagnosis is made with reasonable certainty. In making the incision for removal of the appendix one should bear in mind the findings of Baer and his co-workers, who found that the appendix resumes its normal nonpregnant position in about 10 days after delivery.

### TECHNIC OF APPENDECTOMY

The appendix and the cecum are delivered. Usually this is a simple matter, but in some instances an immobile cecum, adhesions or retrocecal position of the appendix may make this difficult. Often the retrocecal appendix can be delivered by using pieces of tape in a hand-over-hand manner, beginning at the base (Fig. 468). When the appendix is mobile the meso-appendix may be conveniently grasped near the tip of the appendix with a Kelly clamp and the appendix supported with a Babcock clamp (Fig. 469 A).

The meso-appendix can then be ligated



FIG. 468. Technic of appendectomy. Showing method of delivering retrocecal appendix, using successive pieces of tape in a hand-over-hand manner.

en masse with No. 0 chromic catgut, if it is sufficiently mobile (Fig. 469 A). The ligation by a single suture is advantageous when possible in that the cut meso-appendix is then very easily peritonized. Often ligation of the meso-appendix en masse is not feasible, and if this is the case it is clamped with Kelly clamps in a succession of small bites; each bite is ligated individually.

A purse-string suture of medium silk is placed about the base of the appendix (Fig. 469 B). The circumference of the purse string should be great enough to permit easy inversion of the stump. A half-knot is placed in the silk.

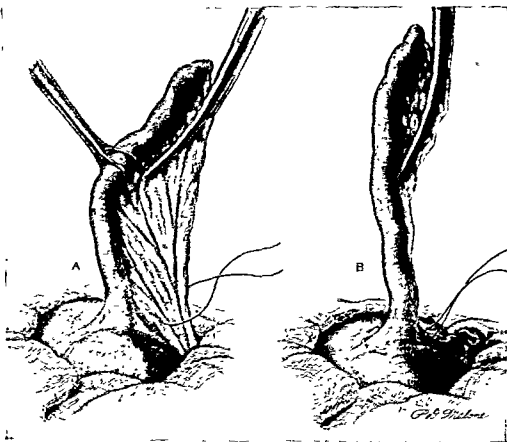


FIG. 469. Technic of appendectomy. (A) Appendix is delivered and supported with Kelly and Babcock clamps as the meso-appendix is ligated. Often this can be done with a single ligature as illustrated. (B) A purse string of medium silk has been placed about the base of the appendix.

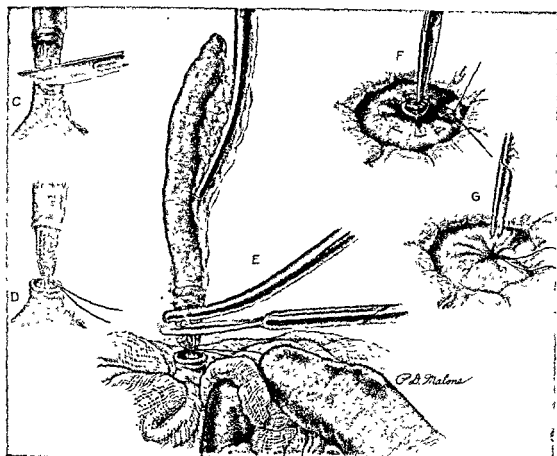


FIG 469 (Continued). Technic of appendectomy. (C) An incision through the serosa is made about the appendix near its base, and the serosa is pushed down. (D) The appendix has been crushed at the point where it has been freed of serosa and ligated with catgut. (D) A Kelly clamp is placed on the appendix just distal to the point of amputation, and the appendix is amputated with the cautery. (F) The stump is inverted as the purse string is drawn tight. (G) The mosquito clamp is withdrawn as the purse-string suture is tied (H) Showing simple method of peritonizing the meso-appendix stump. Fine silk is used for this. (I) Completed appendectomy.

A cuff of peritoneum is turned back after making a circular incision about the base of the appendix (Fig. 469 C).

The appendix is crushed at the point of

denudation with a Kelly or Halsted clamp and tied with No. 2 plain catgut (Fig. 469 D).

A Kelly clamp is placed on the appendix

a short distance distal to the ligature, leaving sufficient space between the ligature and the clamp to permit the passage of the cautery without burning of the ligature.

The appendix is amputated with the cautery (Fig. 469 E). Amputation with the knife and cauterization with carbolic acid and alcohol are equally good technic but involve a few more steps than the simple use of cautery. The appendix and the attached clamps are dropped into a small basin kept on the operating table for receiving the appendix and for the instruments that might be contaminated in doing the appendectomy.

The peritoneal edge of the appendix stump is grasped by the assistant with a mosquito clamp, and the ligature about the base of the appendix is cut short. The sponge, with which the operator protected his finger while holding the ligature, is placed in the "appendix basin."

The stump is inverted, and the purse string is drawn tight (Fig. 469 F and G). The mosquito clamp is dropped into the "appendix basin," and the basin is passed from the operating table.

If the appendix is entirely retrocecal, the meso-appendix need not be peritonized, but generally the cut meso-appendix is peritonized with interrupted sutures of fine silk. Often there is a convenient flap of fat at the terminal portion of the ileum that may be used to cover over the meso-appendix, using 1 or 2 mattress sutures of fine silk (Fig. 469 H and I).

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# The Intestines in Relation to Gynecology

## INTESTINAL ADHESIONS

Adhesion formation between segments of the bowel and between the bowel and the pelvic viscera is both the great friend of the gynecologist and also his great enemy. The formation of adhesions between loops of bowel and pelvic viscera is often responsible for the prevention of the spread of pelvic peritonitis into the upper abdomen. Innumerable times, the sigmoid and the mesosigmoid stop the infection completely, and whereas the pelvic peritoneum is intensely inflamed, the peritoneum above the sigmoid is normal. When subsequent pelvic surgery becomes necessary, these same adhesions may be the source of great surgical difficulties. In addition to infection, operative trauma may be responsible for intestinal adhesions. This may be reduced to a minimum by careful handling of the tissues, avoiding the use, as far as possible, of gauze packs and avoiding the use of packs that are too hot. When possible, all raw surfaces should be peritonized, and at the conclusion of the operation, the sigmoid should be placed over the operative site and the omentum interposed between the bowels and the parietal peritoneum. Nevertheless, in spite of the most careful attention to these details, extensive adhesions will result in some individuals. On the other hand, extensive operations for severe pelvic inflammatory disease may make satisfactory peritonization impossible, and even then a minimum of adhesion formation may result. One can only conclude that there is a great variation in the susceptibility of adhesion formation in different individuals. In an attempt to prevent adhesions, much experimental work has been done. Many different foreign substances have been introduced into the peritoneal cavity, but they have been quite unsuccessful, even act-

ing as irritants in many instances and thus augmenting the very thing they were supposed to prevent.

## SYMPTOMS

Volumes have been written on the symptomatology of intestinal adhesions, and innumerable women have been needlessly operated upon for symptoms which in the light of our present knowledge certainly had no relation to the adhesions. In the past no operative procedure has been more abused than the operation for release of intestinal adhesions. After many years of experience with surgeons, some neurotic women have ended up with multiple scars on the abdomen and an aggravation of their neurotic tendencies, to say nothing of an increase in adhesions with each succeeding operation.

The signs and the symptoms of intestinal obstruction, acute or chronic, constitute a clean-cut indication for surgery. In association with lesions in the pelvis, intestinal adhesions may play a part in symptoms that justify surgery. For example, fibroids and ovarian tumors, often silent growers in the absence of adhesions, may give rise to pain as the result of peritoneal adhesions that are put under stretch by the growth of the tumors. Such tumors might be entirely asymptomatic in the absence of the adhesions, and the adhesions might be equally asymptomatic if it were not for the growth of the tumors; the combination of the two conditions gives rise to symptoms that necessitate surgical relief.

The question of the advisability of separating loops of bowel tied together with adhesions often arises in the course of pelvic laparotomy. Our attitude is one of great conservatism. If the adhesions have been entirely asymptomatic, they are left undisturbed.

verted into the bowel lumen. The first suture line is inverted and reinforced with a second one of interrupted mattress stitches of fine silk (Fig. 470 C).

## INTESTINAL OBSTRUCTION

Intestinal obstruction is essentially a disease belonging in the realm of general surgery, but certain aspects of it are unavoidably linked with gynecology, and its recognition and treatment frequently fall upon the gynecologist. Even though a general surgeon may be available to treat the condition, the early recognition may be up to the gynecologist who has the patient under observation; therefore, he must familiarize himself with the signs and the symptoms. Then, too, partial or complete intestinal obstruction may be a part of the abdominal picture when the major lesion is gynecologic. In such instances the gynecologic operator should be familiar with the proper disposition of the intestinal problem, as well as the strictly gynecologic problem. Since diagnosis will ever remain an imperfect art, there will always be instances in which the gynecologist enters the abdomen in good faith, expecting to attack a gynecologic lesion, only to encounter a lesion primarily in the intestine. Finally, gynecologic surgery, as other abdominal surgery, may be complicated by obstruction postoperatively. The following is an outline of the types of intestinal obstruction encountered by the gynecologist:

### INTESTINAL OBSTRUCTION IN RELATION TO GYNECOLOGY

1. Partial or complete obstruction from pressure of pelvic tumors
  - a. Fibroids
  - b. Benign ovarian cysts
  - c. Carcinoma of the ovary (involvement of bowel wall as well as from external pressure)
2. Obstruction from lesions of the bowel
  - a. Carcinoma of rectosigmoid
  - b. Volvulus
  - c. Lesions of bowel from irradiation of pelvic neoplasms
  - d. Endometriosis of bowel
3. Obstruction associated with peritonitis
  - a. Acute salpingitis and peritonitis
  - b. Acute appendicitis with rupture
  - c. Tuberculous salpingitis and peritonitis
  - d. Postoperative peritonitis

### 4. Postoperative obstruction

- a. Paralytic ileus
- b. Adhesive bands
  - (1) Adhesions from recent operations
  - (2) Adhesions from remote operations

*Pelvic tumors* that commonly choke the pelvis may exert pressure on the sigmoid at or near the pelvic brim and partially or completely obstruct the large bowel. The wonder is that it does not occur more often. It is truly remarkable how the rectosigmoid finds its way through large multiple fibroids. Obstruction resulting from external pressure is usually incomplete and seldom requires an emergency laparotomy. Not infrequently, however, the signs of beginning partial obstruction may necessitate proceeding with an operation promptly, which otherwise might be done at an elective time. Ovarian cancer, in addition to making pressure from without as does a benign cyst or a fibroid, often infiltrates the bowel wall and, indeed, the cause of death in many cases of this disease is intestinal obstruction.

*Carcinoma of the rectosigmoid* is the principal form of intestinal neoplasm with which the gynecologist is of necessity concerned. Differentiation must be made from carcinoma of the ovary. An adherent, nodular, solid mass in the left side of the pelvis may be due to either ovarian neoplasm or carcinoma of the rectosigmoid. The history of obstruction and bloody stools usually directs attention to the primary intestinal nature of the growth, but typical symptoms are not always present. Sigmoidoscopic examination and barium enema usually establish or rule out the diagnosis. In spite of these usually dependable diagnostic procedures, on occasion the gynecologist may enter the abdomen, expecting to find an ovarian cancer, and encounter a carcinoma of the sigmoid or the upper rectum. Then he is called on to handle the situation in the proper manner, and a knowledge of the correct procedures is necessary. Carrying out of the wrong procedure, or doing it in a bungling fashion, may necessitate another operation or make a subsequent operation more difficult or even impossible.

*Volvulus* is of interest to the gynecologist from the standpoint of differential diagnosis

and also of treatment when necessary. Particularly, when the sigmoid is involved is confusion with a pelvic lesion possible. The sudden mechanical twisting of the mesentery may give rise to excruciating pain not unlike that which occurs with an ovarian cyst with twisted pedicle or ruptured tubal pregnancy. The signs and the symptoms of bowel obstruction, particularly the presence of intestinal colic and blood and mucus in the rectum, suggest volvulus rather than the gynecologic conditions. Pelvic examination usually settles the diagnostic question. The twisted sigmoid is often palpable through the vagina or the rectum as an irregular, cystic, very tender mass, in contrast with the tender, smooth-walled mass of an ovarian cyst.

*Injury to the bowel from irradiation* for cervical cancer has been observed in all clinics with extensive experience in x-ray therapy of pelvic malignancy. It more commonly occurs following the irradiation of cervical malignancy than after corpus carcinoma or ovarian cancer. In 1934 Collins and Jones reported an incidence of 1.4 per cent

in 422 cases of treated cervical cancer. With the use of machines of higher voltage the incidence appears to be increasing. In 1937 Corscaden, Kasabach and Lenz reported an incidence of 8.7 per cent of intestinal injuries among 447 cases of treated uterine cancer. In 1942 Aldridge reported a proved incidence of intestinal injury of 16.9 per cent following irradiation of uterine malignancy at the Woman's Hospital of New York. The lesion found in most cases is an annular, fibrous thickening in a localized segment of the intestine, associated with a varying degree of stricture of the lumen (Fig. 471). Such obstructive lesions may be complete or partial and may involve either the large or the small intestine. When the sigmoid is involved, it is often found to be adherent to the uterus. The diagnosis is made by the routine methods of investigation of intestinal obstruction. Barium enema usually reveals the obstructive lesion in the sigmoid. Sigmoidoscopic examination with biopsy may be of value but, owing to the fixation of the bowel, it may be difficult or impossible. In



FIG. 471. Lesion of sigmoid resulting from irradiation for carcinoma of corpus uteri.

FIG. 472. Barium enema of patient with obstructive lesion from endometriosis.

the case of obstruction of the small bowel, a plain film of the abdomen may suffice to determine the approximate area involved. The important thing is to consider always the possibility, when obstructive symptoms develop months or even years after pelvic irradiation. Aldridge found the lesions appearing from 2 months to 5 years after the treatment. It should also be borne in mind that obstructive symptoms occurring after irradiated pelvic malignancy do not always indicate recurrence of the neoplasm.

*Endometrial lesions of the intestines* seldom progress to the stage where obstruction results. Usually, operation is required for the other symptoms of endometriosis long before the intestinal lesion has progressed to the point of obliteration of the bowel lumen. The sigmoid is the segment of bowel most often involved. Blood and mucus are commonly found in the stools when the obstruction is incomplete. When an extensive intestinal lesion is encountered without marked obstruction, complete ablation of the ovaries is usually the proper procedure in women past 40. In young individuals, however, it may be advantageous to resect the bowel lesion rather than castrate the woman. Usually it is the anterior bowel wall which is involved, and the lesion may be excised without a complete resection. Rarely, complete or nearly complete obstruction requires resection and anastomosis. Figure 472 shows a plate of a barium enema in which there was marked obstruction from endometriosis. From a roentgenologic viewpoint the lesion was considered to be carcinoma. An excellent precaution is to have patients with endometriosis in whom there is a suspicion of bowel involvement prepared for bowel resection before operation.

The admission to the gynecologic wards of the most severe cases of *acute neisserian salpingitis* is our practice. Among them are many women with peritonitis of varying severity. Distention, nausea and vomiting are common, and the question of intestinal obstruction often arises. Not infrequently there is the possibility that a ruptured appendix is the primary lesion rather than the inflamed



tubes. Whether the inflamed appendix or the tubes are the source of the peritonitis, paralytic ileus or mechanical obstruction may result. Duodenal suction or the use of the Miller-Abbott tube often decompresses the distended bowel, and eventually the paralytic or even the mechanical obstruction may be overcome, but occasionally laparotomy may be necessary, even in the presence of an acute gonococcal peritonitis. The same problems may arise with *tuberculous peritonitis* and with *peritonitis occurring after gynecologic operations*. With tuberculous peritonitis, the obstruction is more apt to be of a mechanical nature, especially with the dry type of peritonitis.

Gynecology has its quota of *early postoperative obstructions* of the paralytic type and also of the mechanical variety. Recently, Boynton and Bonsnes have reviewed the subject. Since 1942, 9 papers on hysterectomy and 2 on myomectomy have appeared in the literature. These papers report on the incidence of obstruction in 7,890 operations. The incidence of mechanical obstruction was 0.2 per cent and for adynamic ileus 0.9 per cent. At the New York Hospital, Boynton and Bonsnes found an incidence of 0.4 per cent of mechanical obstruction and 0.6 per cent of adynamic ileus. Thus the incidence is found not to be great, but it is a serious complication when it occurs. Hysterectomy and myomectomy are the commonest gynecologic operations to be complicated by this condition, but it occasionally occurs after other pelvic operations.

### SYMPTOMS, SIGNS AND DIAGNOSIS OF OBSTRUCTION

*Pain, vomiting and distention* are the three most common complaints of patients with intestinal obstruction. Pain is apt to be more prominent in mechanical obstruction and results from increased peristaltic contractions attempting to overcome the obstruction. These clinical signs and symptoms of mechanical obstruction become manifest on the average of about the 4th postoperative day and those of ileus on the average of the 3rd postoperative day. However, mechanical obstruction can develop at almost any time postoperatively, whereas paralytic ileus, on the other hand, seems to develop most frequently on the 3rd day.

Since the *pain* caused by intestinal obstruction has characteristics that are of great value in diagnosing the condition, it is of much advantage to defer the use of morphine until one has had an opportunity to obtain a careful history and to examine the patient. Each cramplike pain works up to a crescendo and, after attaining its maximum intensity, gradually subsides. After being free from pain for a few minutes there comes a repetition of this characteristic pain. When the obstruction is of a paralytic type, this intermittent pain is absent, but the patient usually feels very uncomfortable from the distention. When strangulation occurs, the pain becomes more continuous, and there is a localized point of tenderness. The pains due to an ovarian cyst with twisted pedicle or to a tubal pregnancy that has ruptured or aborted into the tube may be as severe or even more so than those due to mechanical blockage of the bowel, but such pains, although often recurrent, do not follow with such regularity. In addition, the pain due to mechanical obstruction of the small bowel is usually more in the midabdomen, while that due to the above-mentioned gynecologic conditions is lower and chiefly unilateral. However, volvulus of the sigmoid can give rise to pain localized in the left lower quadrant and resembling that due to adnexal disease. Biliary colic is usually recurrent, but not with such regularity as intestinal colic. It is maximum in the right upper quadrant and characteristically radiates to the right

scapular region. Renal colic begins in the lumbar region and radiates into the groin; the associated bladder symptoms often give a clue as to the renal origin of the colic. Chills are common with renal and biliary colic and furnish strong evidence against the colic's being of intestinal origin.

Listening over the abdomen with a stethoscope, during the attacks of colic, will reveal borborygmus. The sound of fluid and gas gurgling through the intestines, synchronously with the colicky pain, means increased peristaltic action. This may be due to mechanical obstruction or to increased bowel activity as a result of enteritis. The presence of diarrhea, rather than obstipation, easily differentiates the two conditions. With paralytic ileus the abdomen is silent or almost so.

*Nausea and vomiting* are common symptoms in all acute abdominal conditions which must be differentiated from obstruction. Certain characteristics of the vomiting from obstruction may be of aid in differentiating the condition. When the vomiting is frequent and of great quantity, it speaks for intestinal stasis. Great relief is usually experienced after emptying the stomach of a large volume of its contents, but the intestinal cramps continue when mechanical obstruction exists. In a case of paralytic ileus, the patient usually feels some temporary relief from emptying the stomach, but there is no associated cramplike pain. There is less relief from vomiting when it accompanies acute appendicitis, gallbladder disease or renal colic. The same is true in a case of reflex vomiting associated with acute pelvic conditions, such as a twisted ovarian cyst, ruptured tubal pregnancy or acute salpingitis. Probably the most important single point of diagnostic value with reference to the vomiting is the nature of the vomitus. Brownish-yellow vomitus with a stercoraceous odor is extremely suggestive of obstruction of the small intestine. Vomiting may be present with obstruction of the large bowel, but often it is entirely absent because the ileocecal valve prevents back pressure in the small intestines.

*Distention* occurs with intestinal obstruction in various degree. With paralytic ileus there is maximum distention. In such cases the distended abdomen is almost immobile, and the breathing is entirely thoracic. Disten-

tion due to distended loops of bowel must be distinguished from free gas in the peritoneal cavity. This cannot be determined with certainty by percussion, but by the use of roentgenograms the differentiation is easily made. Differentiation of tympanites from abdominal distention due to the presence of ascitic fluid, pus, blood or tumor in the peritoneal cavity must be made, and this is usually possible by inspection, percussion, palpation and vaginal or rectal examination.

When partial mechanical intestinal obstruction has been present for some time, hypertrophy of the musculature of the bowel above the point of obstruction results. In such cases there is a history of previous abdominal cramps. Often the mighty peristaltic contractions of such hypertrophied bowel may be seen through the abdominal wall as moving patterns. This holds true particularly when the abdominal wall is thin. Usually with mechanical obstructions of short duration no peristalsis is visible, unless the abdominal wall is very thin; with paralytic ileus no motion can be seen through the distended wall.

*Muscle spasm* is variable with intestinal obstruction, being dependent on a complicating pathologic lesion. When a loop has become strangulated, there may be localized spasm over it. Muscle spasm is maximum in case of a complicating upper abdominal lesion, such as a perforated stomach or a duodenal ulcer. It may also be marked when there is a colon bacillus peritonitis, resulting from the rupture of the appendix or the lower bowel. Blood from ruptured ectopic pregnancy, urine from a ruptured bladder, pus from acute salpingitis may all give rise to a chemical or purulent peritonitis with varying degrees of muscle spasm. However, it never should be overlooked that generalized peritonitis may be present with a remarkably soft abdomen.

The *general condition* of the patient varies markedly with the degree of obstruction, the duration of the obstruction, the presence or the absence of peritonitis and the type of treatment that she has received. Early in the disease the general appearance may be so good as to belie the seriousness of the lesion. Often the temperature and the pulse rate are normal at that stage, or slightly elevated.

When infection or a strangulated segment of bowel is present the pulse rate and the temperature are elevated. Late in the course of the disease, when fluids have not been supplied in sufficient quantity, the features become sunken, the face anxious, the pulse thready, the blood pressure low and the extremities cold. Most cases of obstruction, when first seen by the surgeon, have lost much fluid that has not been replaced in sufficient quantity. As a result of this, there is hemoconcentration resulting in high hemoglobin content and leukocytosis. The leukocyte count usually runs higher with high obstruction than with low. In a case of gangrenous loop of bowel, there is particularly apt to be an elevated white count, but a leukocytosis by no means necessarily indicates strangulation. Owing to fluid loss by vomiting, urine is scanty and concentrated and contains albumen when the obstruction has been present for some time. When intravenous fluids are supplied in sufficient quantity, the urine approaches normal. Wangensteen warns against relying too much on elevation of blood nonprotein nitrogen, decrease of the plasma chlorides and alkalosis as diagnostic signs of obstruction. Such changes occur regularly only when the obstruction is at the outlet of the stomach and the upper jejunum, and only after fluid loss for over 48 hours. The lower the obstruction the less apt are these changes to occur.

#### ROENTGENOLOGIC EVIDENCE

Roentgenograms properly done and interpreted are of the greatest aid in diagnosing intestinal obstruction. In the normal adult a flat plate shows only gas in the stomach and the large bowel. The small intestine contains a mixture of gas and fluid that does not appear as gas in the x-ray film. When the small bowel is obstructed, the gas and the fluid separate. When the flat plate is taken with the patient erect, gas is visualized over the fluid levels (Fig. 473). If the patient is too ill to stand, she may be x-rayed on her side and fluid levels demonstrated. Often a plate taken in the supine position will give a fairly accurate idea of the location of the obstruction. Gas at the lateral borders of the abdomen in normal women is in the colon. The long axes of these gas shadows



FIG. 473. Standing flat plate of abdomen, showing shadow of fibroid in the lower abdomen and fluid levels in the intestine, indicating intestinal obstruction due to pressure from fibroid.

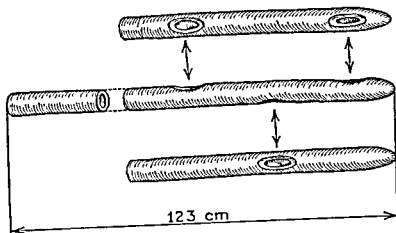
are vertical; intestinal wall shadows are thicker than those of the small intestines. Gas in the small intestine is characterized by its central location; the long axes of the shadows are transverse, and when the loops appear markedly dilated, the intestinal wall shadows separating adjacent loops are very thin. If the shadows separating the loops are heavy, they suggest fluid or exudate. If loops of the small intestine are distended but gas is also present in the colon, the patient probably has a partial obstruction of the small bowel with some gas getting through into the large intestine. Usually by the time the patient is seen in the hospital she will have had many enemas and will have evacuated the gas from the large bowel; therefore, when obstruction in the small bowel is complete, the small bowel is dilated, and no gas exists in the colon. It is important to bear this in mind when the patient is under treat-

ment with suction, for the appearance of gas in the large intestine, after it was found to be absent, indicates that the obstruction has been at least partially overcome.

The administration of barium by mouth in acute obstruction is contraindicated. Occasionally, a small amount of a very dilute solution may be given through a Miller-Abbott tube in order to locate the obstruction. It may be removed by suction immediately after taking the plate. At times a thin barium enema may be justifiable to determine whether a certain distended loop is small or large intestine. In chronic or sub-acute obstruction of the large bowel, a barium enema helps to localize the obstruction.

Usually enemas will have been administered repeatedly before the patient suspected of obstruction enters the hospital. When enemas are given, their results should be

FIG. 474. Levin tube. Duodenal catheter, showing three openings.



interpreted cautiously. The large bowel below the obstruction is capable of generating some gas that may be expelled. The report by a nurse of "flatus expelled" should not exclude the diagnosis of obstruction. The absence of gas expulsion by enema is evidence for the diagnosis of obstruction; the passage of great quantities of gas is evidence against obstruction; but the passage of small amounts should not be taken too seriously. Even when a fairly large volume is passed, the surgeon should not disregard other signs and symptoms pointing to obstruction.

#### TREATMENT

Until several years ago when the suction treatment was introduced, there had been no appreciable improvement in the mortality rate of intestinal obstruction since the earliest days of abdominal surgery. Since those days it has been apparent that delay in operative intervention greatly increases the mortality. For example, Finney reported a mortality rate of 36 per cent in 217 cases of obstruction, but of the cases operated upon in the first 5 hours, the mortality rate was 5 per cent. Such figures clearly indicate the advantage of early operation, and surgeons have been emphasizing this advantage for years. In spite of this, there was no improvement in results until the suction era. The advantages of suction are evident if we compare statistics before and after its general use. In 1913 McGlannon reported a mortality rate of 37 per cent; in 1915 Deaver and Ross reported 42 per cent; in 1920 Codman reported 34 per cent; and in 1920 Richardson reported 41 per cent. In 1921 Levin introduced the smooth-tipped duodenal tube. After this had been in general use,

statistics began to improve. Wangenstein and Paine in 1933 reported a mortality rate of 15.6 per cent; Johnston, in 1940, reported 19.1 per cent; and McKittrick and Sarris reported 20 per cent. There can be little doubt that the general use of suction is the greatest factor in the improved statistics, but other factors probably play a role. The public has become more hospital minded, and patients with obstruction are finding their way into hospitals earlier; patients are better prepared for operation by the use of intravenous fluids, and they receive better postoperative treatment; also, there has been some improvement in the choice and the execution of surgical procedures.

When first seen by the surgeon, every case of intestinal obstruction presents the problem of whether one should proceed at once with surgery or give suction a trial. Nothing in surgery requires better judgment. The value of early surgery has been proved abundantly. On the other hand, by means of suction, surgery may be avoided in many instances, and in others the general condition of the patient may be greatly improved and the deflated bowel may be put in condition so that surgery, which would be quite impossible on the distended bowel, can be performed successfully. When reasonable evidence points to strangulated bowel, immediate surgery is strongly indicated. Also, when the obstruction lies in the colon, and there is great distention, nothing will be gained by suction, and valuable time is lost. When all available evidence points to small-bowel obstruction and one finds no evidence of strangulation, Wangenstein believes that little is lost by a trial with suction through an inlying duodenal tube (Fig. 474). Adhe-



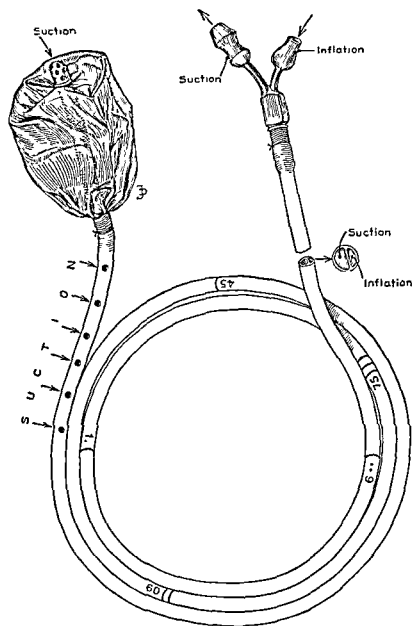


FIG. 475. Miller-Abbott tube. Note the deflated balloon, the suction tip and the openings along the tube. Note cross section of the tube, showing double lumen for suction and inflation.

sive obstruction in a case of incomplete stoppage is often cured by decompression alone. This holds particularly true when adhesive obstruction is of recent origin, but frequently it also holds true when the adhesive band is of remote origin.

Obstructions, such as one often sees on a gynecologic service where pelvic inflammatory masses make pressure on the bowel and where the inflammation has extended to the bowel wall, not infrequently are relieved by decompression, and with subsequent sub-

sidence of the inflammatory condition no further treatment will be necessary. However, when evidence of re-establishment of the intestinal lumen does not present itself within 24 hours, suction should not be persisted in for a long time. Wangensteen warns against persisting in suction if no operative scar is seen on the abdomen, since the likelihood of simple obstruction by adhesive bands is not nearly as great when there has been no previous operation. Wangensteen further emphasizes the necessity of following pa-

tients who are being treated with suction with frequent x-ray films. The appearance of gas in the colon, when it was absent before, and diminution in the size of the distended loops of small bowel are reasons for feeling encouraged in continuing the suction treatment.

Wangensteen lists the signs of successful decompression as follows:

(1) Cessation of gas pains; (2) decrease of distention; (3) the visualization of gas in the colon on the x-ray film in complete obstruction, indicating that the obstruction has been overcome; (4) less fluid aspirated through the duodenal tube, denoting that stasis is no longer prominent; and (5) tolerance of temporary discontinuance of suction without recurrence of pain.

Wangensteen lists the shortcomings of suction as:

(1) Drainage of the gut is done at a point remote from the site of obstruction, necessitating the removal of a much greater quantity of gas and fluid to permit of the intestine automatically adjusting itself and re-establishing its continuity, than if the gut had been drained by enterostomy near the point of obstruction; (2) in the interval during which one waits for the obstructing mechanism to relent, the gut above the obstruction cannot be employed as a nutritive tube, as it can when the gut is drained near the point of obstruction. The Miller-Abbott tube, however, circumvents this latter difficulty, in that patients may eat with the tube in place after decompression has been effected.

In 1934 Miller and Abbott devised a tube with double lumen and balloon tip for intestinal intubation (Fig. 475). Such a tip can be propelled for a great length down the intestine after its passage through the pylorus. The use of this tube has been a great step in the improvement of the conservative treatment of obstruction. It has an advantage over duodenal tube suction in that it is able to evacuate the bowel contents for the full length of the intestine, proximal to the site of obstruction. Often the patient can be carried along with a gradual decompression of the bowel and the administration of fluids until her condition is markedly improved so that she will tolerate the operation better. The regaining of tone in the formerly dis-

tended loop reduces the chances of tearing of the bowel and makes the necessary surgery much easier. Often the approximate point of obstruction can be determined. Miller and Abbott recommend the occasional injection of 50 to 100 cc. of weak solution of barium before taking the roentgenogram to determine the site of obstruction. If the obstruction is complete, the barium may be sucked back immediately after the film is taken. The obstruction may be completely overcome by release of tension above the obstructed point, and no surgery may be necessary. Even if the obstruction is not entirely overcome, the complete obstruction may become partial, and the emergency operation becomes one of choice when the condition of the patient has greatly improved. Fluids and food may be given by mouth during this treatment. It is the most successful treatment known for paralytic ileus and the only treatment whereby the entire small bowel may be decompressed.

Advantageous as all of the above appears to be, it should be emphasized that there are difficulties and disadvantages with the use of the Miller-Abbott tube. Like duodenal suction, it is not suitable when the evidence suggests strangulation. Persistence in its use when strangulation is present may result in the death of a patient who could have been saved if prompt surgery had been done. Like duodenal suction, the Miller-Abbott tube is not suitable for use when the obstruction lies in the large bowel. Such cases require prompt surgery. Successful use of the Miller-Abbott tube requires almost constant attention. Many failures are the result of impatience and unwillingness on the part of the surgeon to give the necessary time and attention to ensure its passage down the intestinal tract.

The technic of introducing the tube has been described by Miller and Abbott as follows:

The technic of intubation, as we have practiced it, is simple. The tube with the bag deflated is taken by the fasting subject in the early morning, exactly as the gastric and duodenal tubes, only enough being swallowed at first to reach the stomach, and then with the subject reclining on his right side, more is introduced slowly until the distal end has reached the duodenum. Entrances into the duodenum may be deter-

mined by the character of the contents obtainable through the lumen "B," or preferably by fluoroscopic observation. The special posture is no longer required, but a little more tube is taken, and fluoroscopic observations are made until the capsule has reached at least the third portion of the duodenum. Then the bag is distended moderately with air or an 8 per cent sodium iodide solution (to render visualization of the tube and bag easier). After this, the subject swallows about 5 cm. of tube every 10 minutes, fluoroscopic observations being made from time to time until the distal end has reached the desired point.

We have found that within 6 hours the tube has usually passed along the bowel to a distance of 120 to 150 cm. beyond the pylorus. According to Einhorn the length of tubing required to reach from the pylorus to the cecum in the living human is approximately 270 cm.; this suggests that our tube usually reaches the halfway point in the small bowel within 6 hours. In confirmation of this is the fact that fluoroscopic observation of a barium solution injected at the termination of a tube passed 120 to 150 cm. beyond the pylorus does not usually show evidence of valvular conniventes, which are present only in the upper two-fifths of the small bowel, the jejunum, this indicating that the ileum has been reached.

Thus without the necessity of having the subject take any food and within the early half of the day, the apparatus can be introduced into the upper ileum. Beyond this point it does not go so rapidly, probably because of the slight rigidity of the tube, but we anticipate that with an improved type of tubing even deeper penetration may be secured within the same period of time.\*

The great difficulty lies in getting the tube into the duodenum. Sometimes this is simple and rapid; at other times it is difficult, and failures are not uncommon. In 1941 Abbott described a method of intubating the duodenum by employing a piece of piano wire as a stilet which perforates the side of the tube 2 feet proximal to the balloon, terminating just proximal to the suction holes in the catheter. Under the fluoroscope the tube could, at times, be inserted into the duodenum promptly. In that same year Siverton suggested to Wangensteen the use of mercury in the balloon to facilitate the carrying of the balloon into the duodenum. In 1944

Harris reported the successful use of 4 to 8 cc. of metallic mercury in the balloon to add weight to the tip of the tube. We have employed this with a much higher percentage of successes than formerly.

### *Supportive Treatment*

Having established the diagnosis of intestinal obstruction or having seriously suspected it, supportive treatment is indicated in most cases, whether suction is used or surgery resorted to immediately. The chief supportive agencies are the intravenous administration of sodium chloride, potassium, glucose, plasma and blood. In those cases in which operation is deferred while suction is used, these supportive measures may be used to great advantage for days. Even in those cases of strangulation and obstruction of the large bowel where surgery is urgently indicated, fluids are of great value preoperatively. Regardless of the type of obstruction, one rarely sees a case of intestinal obstruction enter the hospital which does not show some evidence of dehydration. Especially in high obstruction, the loss of water and chlorides is marked, and urinary output is diminished or stopped. In low obstructions there is less vomiting, but fluid intake is small, and intestinal absorption poor; hence, oliguria is the rule.

Thirst, dry skin, sunken appearance of the face and oliguria indicate dehydration. The plasma chloride level is the best guide as to the chloride deficiency. The normal sodium chloride level varies from 560 to 600 mg. per cent. Coller has suggested that for each 100 mg. per cent that the plasma chlorides are deficient, the patient should be given 0.5 Gm per kilogram of body weight. According to Wangensteen, such estimates coincide quite accurately with clinical trials. Enough salt solution should be given to produce a urine output of 700 to 1,000 cc., in which a total of 3 Gm. of sodium chloride may be demonstrated. If the specific gravity of the urine is 1,012 to 1,020 one may be quite certain that fluid and salt requirements have been met. It is our practice to administer salt solution mixed with an equal volume of 5 per cent glucose. The glucose supplies nourishment, which is usually deficient, and combats ketosis due to starvation.

Blood transfusion is indicated preopera-

\* Miller, T. G., and Abbott, W. O.: Intestinal intubation: a practical technique, *Am. J. Med. Sci.* 187:597, 598, 1934.

tively in those cases in which one finds evidence of blood loss from a strangulated segment of bowel. Even in those cases in which blood loss is negligible, there may be a rapid, thready pulse and a blood pressure approaching shock level. In such cases blood or plasma is indicated. Plasma is especially indicated with chronic obstruction when prolonged lack of nourishment has brought about low blood protein. When obstruction is associated with gynecologic conditions such as fibroids and severe pelvic infections, there is often anemia independent of the intestinal condition, and whole blood should be administered before operation is done.

### *Surgical Treatment of Obstruction*

Although suction has reduced the number of cases in which surgery is necessary, operation remains the most important agent at our disposal for the treatment of mechanical obstruction of the bowel. Final success in treatment usually depends on a well-chosen and well-executed surgical procedure. As has been stated before, surgery is urgently indicated when evidence exists of strangulation obstruction and when there is acute obstruction of the colon with marked distention. According to Wangenstein, the two principal questions to be answered when considering surgical treatment are: "Is the obstruction early or late? Is it simple or strangulating in character?" If there is a serious suspicion of strangulation, operation should be done without delay. It is a less serious error to operate and not find strangulated bowel than to defer operation too long when strangulation is present. When the peritoneal cavity is opened, bloody peritoneal fluid almost always means infected gut, and it is the obligation of the surgeon to find it and treat it as indicated.

Fortunately, simple obstruction is the type most frequently encountered by the gynecologist. Postoperatively, following recent or remote gynecologic operations, fibrinous adhesions or adhesive bands are the usual cause of mechanical obstruction. The obstructions that one sees in connection with pelvic lesions are usually the result of pressure from tumors or of adhesions resulting from pelvic inflammatory disease. In this latter group there is a twofold problem; the release of

the obstruction and the treatment of the pelvic condition. The surgical treatment of the pelvic lesion may be necessary in order to relieve the obstruction permanently. When the obstruction is early and the pelvic operation not too difficult, it may be carried out, and both conditions promptly relieved. However, often the pelvic operation promises to be long and difficult and more than the obstructed patient can tolerate. The immediate problem, then, is to improve the patient's condition, if possible, by intravenous fluids and suction until surgery can be undertaken. If a trial with suction and intravenous therapy is unsuccessful in improving the patient's condition, surgery will have to be undertaken regardless of the condition of the patient. In such cases a minimum of surgery should be done, such as a quick release of the obstructing adhesion or simple enterostomy, leaving the cure of the gynecologic condition for a later time. If acute pelvic inflammatory disease is present, surgery for the pelvic condition should not be attempted. Simple release of adhesions or enterostomy may be all that is necessary; when the pelvic inflammatory process subsides there may be no need for pelvic surgery, and usually there is no further obstruction. Occasionally, the separation of the bowel from the obstructing mass or band may result in injury to the bowel wall, or pressure may have necrosed a small area. Inversion of the injured or necrosed area as shown in Figure 476 may become necessary. When inversion is required in the small intestine, it is usually best done transversely to prevent encroachment upon the lumen.

In late simple obstruction when the patient is in a condition too critical to justify hunting for and releasing of the guilty adhesions, an enterostomy performed on the bowel, proximal to the obstruction, may be a life-saving measure. Often, no further surgery ever becomes necessary, for with the deflation of the proximal loop the obstruction may straighten out itself. When enterostomy is done, it is best to do it as close to the point of obstruction as possible. The lower the enterostomy, the better the chance of success. A very high enterostomy is little better than duodenal drainage. However, in some critically ill patients a prolonged hunt for the site of obstruction is not advisable,



FIG. 476. Inversion of small gangrenous area in gut. (A) The ends are closed with so-called 3-2 mattress stitches, ensuring closure of ends. (B) The remainder is closed with interrupted mattress sutures of fine silk.

and a blind enterostomy must be done on a proximal distended loop.

On occasion, we have found entero-anastomosis a useful procedure in gynecology when obstruction results from adhesion of the bowel to a malignant pelvic mass, especially after irradiation. If the patient's condition is very poor, it may be unwise to relieve such an obstruction and permit her to suffer the agony of a slower death from malignancy. Sometimes, on the other hand, the general condition of the patient may be remarkably good in spite of extensive malignant pelvic involvement. To attempt to release the obstructed bowel from the malignant mass would be difficult and probably would result in a dissemination of the cancer. Therefore, the indicated procedure for relief of the obstruction is entero-anastomosis. It is our custom in such cases to perform a lateral anastomosis of the small bowel, as illustrated in Figure 479. Entero-anastomosis is also a wise procedure when the obstruction lies in a mass of adhesions that is almost impossible to unravel, or when the patient's

condition is such that resection of the mass of adherent bowel is not feasible.

When strangulation of the bowel is encountered, the first question that arises is whether or not the segment of bowel is viable. The keenest of surgical judgment is often required to decide whether to resect, exteriorize or permit the bowel to remain in the abdomen. Owings and Smith have made a special study of this, and their opinion is probably the best obtainable. Therefore, we quote from their conclusions:

The more experiments we did the harder we felt this point was to determine with any degree of exactness. We felt that the best thing to judge by was, first, the ability of the bowel to contract when mechanically stimulated; that is, not only ability to contract but to contract completely, go into actual spasm. This spasm is readily induced by tapping the bowel with a clamp or pinching it or plucking it with the finger. It is important to notice whether this bowel at the height of its contraction comes down to the size that one would expect normal bowel to reach under similar stimulation, because this

helps to determine the degree of edema which is the best expression of the early reaction of the bowel to obstruction.

Secondly, the circulation of the bowel wall and the mesentery is very important. There should not be any edema of the mesentery, and pulsations should be clearly seen and felt in the mesenteric vessels. The circulation of the bowel wall itself is best determined by its color during both spasm and relaxation. It is also important and at times difficult to know just where to resect and what bowel is suitable for anastomosis. During relaxation a point should be picked where the color of the bowel wall changes from dusky, nonglistening color of damaged circulation to a point as near the normal pinkish glistening color as possible. This point is very hard to determine as the change is a very gradual one and the normal color is never actually reached. One has to be governed by the comparison and by experience, together with other points that we have brought out. The bowel wall at the point of resection when in the spastic stage should be nearly white in color, showing that the capillaries are not thrombosed, since the blood is expressed from them by the force of the contraction. In obstructed bowel where the circulation is damaged and there is beginning gangrene, even though the bowel will contract it remains rather dusky in color, probably due to thrombosed capillaries.

Thirdly, we found that in suturing obstructed bowel the needle meets increasing resistance as one goes from badly damaged bowel wall toward that which is approximately normal, and this is one of the tests that we use to determine a suitable point. We feel that this is due to edema of the submucosa since this layer is the one that causes resistance to the passage of the needle. In doing the anastomosis there is always, even at the point of resection, some difference between the resistance to the passage of the needle through the wall of the upper end of the lower segment. This shows that even where anastomoses will hold and resection is safe this edema still persists to some extent.\*

When *mesenteric thrombosis, volvulus, strangulated hernia, intussusception, or devitalized bowel due to adhesions or operative injury* incurred while dissecting bowel from pelvic lesions make it necessary to remove a segment of small bowel, primary resection and anastomosis are the ideal procedure.

However, when the condition of the patient forbids a procedure requiring that length of time, exteriorization may have to be done. In general, the higher the position in the alimentary tract that the lesion occurs, the more one should avoid exteriorization. If exteriorization of the upper small bowel is unavoidable, the harmful systemic effects may be avoided for a short period of time by collecting the fluid from the upper segment and running it, by catheter, into the lower segment. When primary resection and anastomosis become necessary, in most instances it is better for the gynecologist to do an open lateral anastomosis. Since intestinal surgery is done rarely by the gynecologist, it is best for him to do as simple a procedure as possible; hence, it is usually well for him to avoid the technically more difficult end-to-end anastomosis. Whenever an anastomosis of small bowel is done in the presence of distention, an enterostomy had best be done above the anastomosis.

In the large bowel the lesions most commonly encountered by the gynecologist are *volvulus of the sigmoid, carcinoma of the sigmoid and diverticulitis*.

When *volvulus* is operated on in the earliest stage, simply untwisting may restore the circulation and nothing more need be done. When the bowel wall is devitalized, it should be exteriorized by the Mikulicz method, opened immediately and the continuity of the bowel established by gradual crushing of the spur. If the viability is questionable, the sigmoid may be exteriorized and a colostomy done above that point. If the circulation of the sigmoid is restored satisfactorily, it may be dropped back into the abdomen. If not, it may be excised as in the Mikulicz procedure.

*Carcinoma of the sigmoid* is occasionally encountered by the gynecologist in association with a pelvic condition for which the operation is primarily done, or it may be mistaken in diagnosis for carcinoma of the ovary. When obstruction is present, primary resection and anastomosis is contraindicated. It has been amply proved that the mortality of sigmoid resection is many times greater if a primary anastomosis is done in the presence of obstruction than when done after decompression of the proximal colon. When there is obstruction, a colostomy should be

\* Owings, J. C., and Smith, I. H.: Massive resections in acute mechanical intestinal obstruction, *Ann. Surg.* 95:840, 1932.

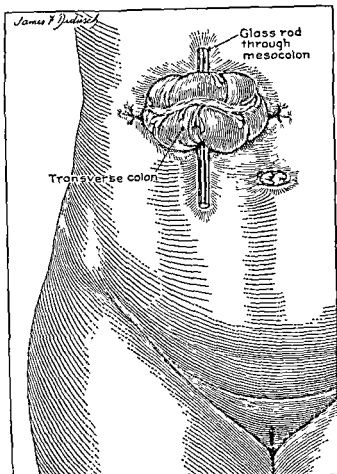


FIG. 477. Transverse colostomy through a high, short, transverse, right-rectus incision. The colon is held in position with a glass rod.

done, and Wangenstein recommends using the transverse colon for this. He prefers to do this operation through a right transverse incision (Fig. 477). At a later time the sigmoid is resected if the carcinoma is operable. At the time of the laparotomy when the lesion is discovered the gynecologist should get all the information possible which may be of value when resection is done at a later time. The bowel lesion should be inspected and palpated for mobility; the regional glands should be palpated and the liver felt for metastases. If the sigmoid is easily exteriorized, the first stage of the Mikulicz operation may be done. The author believes that in suitable cases this is an excellent procedure, especially for the gynecologist whose experience in intestinal surgery is, of necessity, limited. It is the opinion of the author that the resection should be done at a later date by an experienced intestinal surgeon and

after proper bowel preparation. If the lesion is not obstructive, the abdomen should be closed without resection and subsequently operated upon by an intestinal surgeon after bowel preparation.

**Technic: Enterostomy.** The segment of bowel to be used is carefully protected from the peritoneal cavity by gauze, since the contents of the obstructed bowel are very heavily infected.

The contents of the bowel are emptied from the segment that is to be used for the enterostomy by milking with the fingers as shown in Figure 478 A. The segment is then clamped off with rubbershod clamps.

A purse-string suture of medium silk is laid near the left end of the isolated segment, and the bowel is punctured with a trocar within the area encircled by the purse string. The segment is further cleansed of its contents by suction. As the trocar is withdrawn

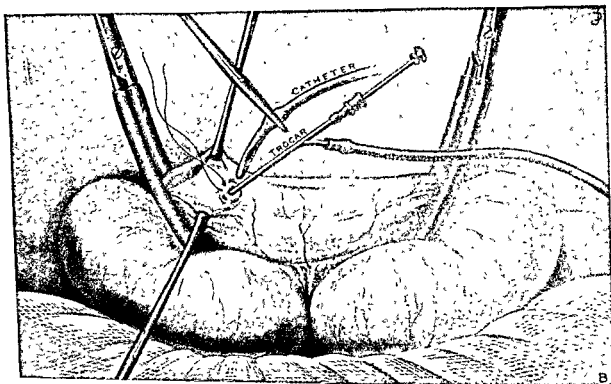
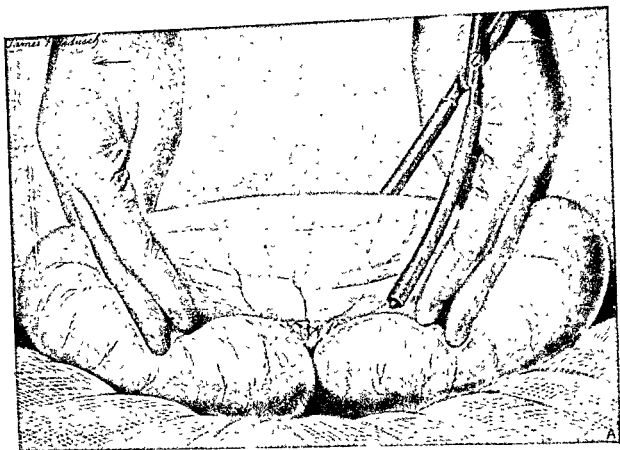


FIG 478. Enterostomy. (A) The distended bowel segment is stripped of its contents. (B) A purse string has been placed, and a trocar has been inserted. A catheter is about to replace the trocar.



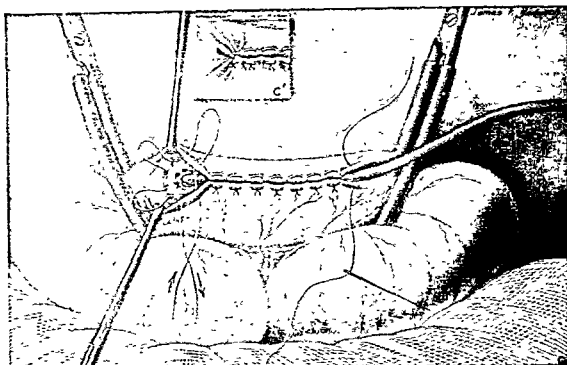


FIG. 478 (Continued). Enterostomy. (C) The catheter is being fixed in a tunnel in the bowel wall. Note the 2-3 suture that covers the purse string and the suture that fixes the catheter by passing through the wall of the tube. (C') The 2-3 suture tied.

a male catheter is quickly slipped into the opening, care being taken to avoid soiling (Fig. 478 B).

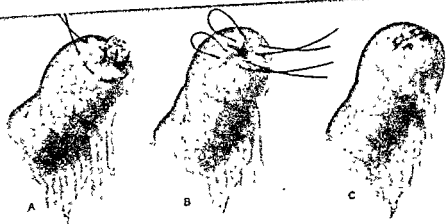
After the catheter has been fixed by drawing the purse string tight, it is buried by infolding bowel wall over the catheter for a length of about 6 cm. The purse string is covered by using the 2-3 stitch, and the catheter is further fixed in position at the opposite end of the suture line by including a bit of it in the last suture (Fig. 478 C). The catheter is infolded by using mattress sutures of medium silk, but the suture that fixes the tube is of No. 0 chromic catgut in order to permit the catheter to be withdrawn later.

**Technic: Lateral Anastomosis of Small Intestine.** The mesenteric vessels supplying the piece of bowel to be resected are clamped, cut and ligated. The bowel is crushed on either side of the area to be resected with Ochsner clamps and is tied with No. 2 chromic catgut. A purse string of medium silk is placed in the bowel, just beyond the points tied, for inversion of the

stump. Ochsner clamps are used to clamp off both ends of the segment to be removed and with the actual cautery the bowel is transected. Figure 479 A shows ligated bowel with encircling purse string. The purse string is drawn tight as the bowel end is inverted. The purse string closure is reinforced with two mattress sutures of fine silk (Fig. 479 B and C).

The two ends of the bowel that are to be anastomosed are laid side to side, and two traction sutures are placed to hold the bowel so that when the anastomosis sutures are placed the antimesenteric surfaces of the bowel will be in apposition. A row of fine-silk interrupted sutures is placed as in Figure 479 D. The sutures should penetrate the bowel wall to the submucosa, but care should be exercised to avoid penetration through the mucosa. The sutures are tied and cut short.

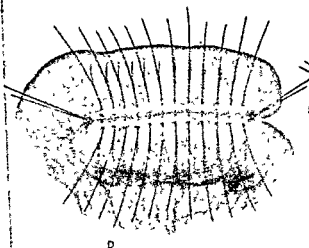
Then two parallel incisions are made into the lumina of the bowel as shown in Figure 479 E. The edges of these incisions are



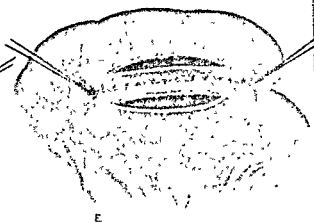
A

B

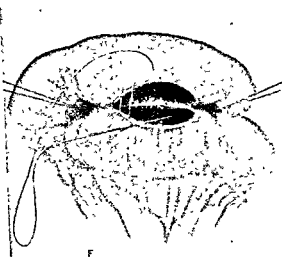
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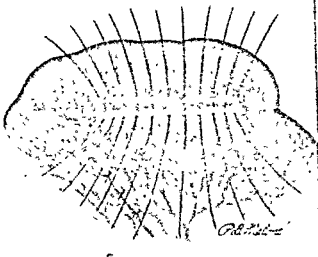
D



E



F



G

Fig. 479. Lateral anastomosis of the small intestine. (A) The bowel has been tied off with No. 1 chromic catgut, and a purse string of medium silk has been put in place. (B) The purse string has been tied and is being reinforced with two silk mattress sutures. (C) The mattress sutures have been tied. (D) The outer posterior row of interrupted silk mattress sutures has been placed. (E) Parallel openings have been made in the bowel. (F) A continuous catgut suture has approximated the cut margins of the opening posteriorly and is being continued anteriorly. (G) The outer anterior row of interrupted mattress sutures has been placed, and opening in the mesentery has been closed.

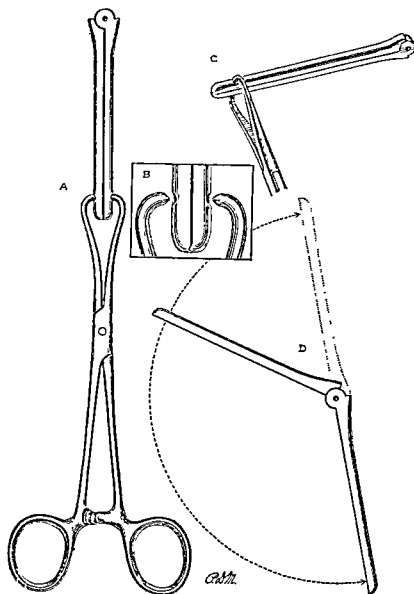


FIG. 480. Stone intestinal clamp. (A) Clamp closed and locked. (B) Showing method by which clamp is locked. (C) Demonstrating how clamp and locking device may be turned at right angles. (D) Opened jaws.

united, beginning at the right angle, continuing posteriorly and then to the anterior wall as shown in Figure 479 F. The nature of this stitch is shown in Figure 479 F. The needle point is inserted into the serosa about 2 mm. from the cut edge. It passes through the muscularis and emerges on the cut edge of the bowel wall. In this manner the edges are rolled into the lumen of the bowel. No. 0 chromic catgut on a straight nontraumatic needle is used for this suture.

This suture line is reinforced anteriorly with a row of interrupted sutures of fine silk.

The same technic of lateral anastomosis

may be used for short-circuiting a segment of bowel by entero-anastomosis.

**Technic: Stone Method of End-to-End Anastomosis.** Formerly, the Stone closed method of anastomosis was used by us frequently. Today most resections and anastomoses are done by the open method after preoperative bowel preparation. However, if resection should become necessary on the unprepared bowel, we believe that the Stone method is the method of choice. Therefore, the description is permitted to remain in this edition.

The use of this technic (Fig. 481) depends upon a familiarity with the Stone clamp that is pictured in Figure 480. The clamp possesses firmness and security which are necessary for the aseptic type of anastomosis and has adaptability because it may be used as a straight or right-angle clamp. The clamp is formed from two pieces: the hinged jaw and the compressing handle. The

jaws are narrow and grooved longitudinally. Near the tip of each jaw is a square pyramidal hole sunk to receive the squared pyramidal points of the compressing handle. The handle of the clamp has ice-tong blades and finger rings. It locks with a ratchet catch. Figure 480 A shows the clamp closed at 180°. Figure 480 C shows the clamp closed at 90°.

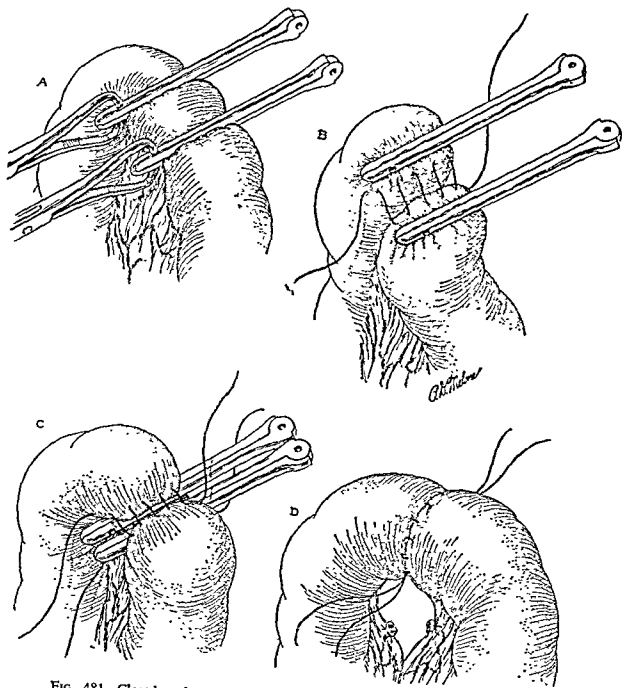


FIG. 481. Closed end-to-end intestinal anastomosis. (A) Clamps have been placed, closed and locked in position. (B) Posterior continuous Cushing suture has been placed. (C) A similar anterior suture has been placed. (D) Clamps have been withdrawn and sutures tied.

Stone describes the technic of end-to-end suture as follows:

The gut is crushed across at the desired level by crushing clamps leaving a groove. The hinged jaw piece of the clamp herewith described is placed across the gut at the crushed groove and solidly locked in place by setting the handle-piece firmly into the sockets in the tips of the jaw piece (Fig. 481 A). The portion of gut to be removed is cut away with the cautery close against the anastomosis clamp. The same procedure is applied to the other end of the gut to be resected, and the ends to be anastomosed, held firmly by the special clamps, are brought closely together, end to end. A continuous suture of medium silk unites the gut wall of each end behind the clamps, which are rotated slightly away from each other during placing of the sutures (Fig. 481 B). The ends of this posterior suture are tied. Now the clamps are rotated toward each other and a similar suture unites the gut walls in front of the clamps (Fig. 481 C), but in this suture the ends are not tied but left loose so that the stitch may be drawn taut after clamps are removed. The compressing handles are now released from the tip of the hinged jaws and set on the hinged joint end instead. By gentle pulling the jaws are withdrawn from between the rows of sutures, front and back, the front row being pulled taut as the jaws of the clamps are slipped out. The corresponding ends of the front and back sutures are tied together and the anastomosis is accomplished (Fig. 481 D). It can be further supported by an additional row of mattress or continuous sutures if so desired.\*

It is our custom always to reinforce the suture line with a row of mattress sutures of medium silk.

**Technic: Open Anastomosis of the Large Bowel.** The bowel is treated preoperatively with neomycin or neothaladine. Recently, we have favored neothaladine, giving 15 cc. every 4 hours for 24 hours and then 15 cc. every 6 hours for another 24 to 72 hours. Before this treatment is begun the large bowel is cleansed with a soapsuds enema. Some operators choose to give a 200-cc. neomycin retention enema several hours before surgery, but we do not consider this to be necessary.

Rubber-shod clamps are applied, at a

\* Stone, Harvey B.: Method of intestinal anastomosis with a new clamp. *Surg., Gynec. & Obst.* 65:383, 384, 1937.

suitable distance from the excised area, not too tightly but tight enough to prevent the annoyance of the scanty bowel contents. Appendices epiploicae are removed from region of anastomosis to secure good apposition of the bowel wall. Guy sutures of fine silk are placed on either side, midway between the mesenteric and the antimesenteric borders of the bowel; they include the serosa and the muscularis only. These are left long and held with forceps. Interrupted seromuscular silk sutures (Lembert) are placed at intervals of about 5 mm. and join the posterior edges of the bowel ends (Fig. 482 A). The needle bearing the suture passes at right angles to the wound edge and passes through all the coats of the bowel except the mucosa. It is introduced about 5 mm. from the edge of the wound and emerges a 1 or 2 mm. from the edge on the same side. It passes over to the opposite edge where the suture is repeated. On complication of this layer posteriorly the mucosa is approximated with a continuous "over and over" suture of No. 000 chromic catgut on an atraumatic needle. This suture is begun in the middle of the posterior edge as shown in Figure 482 B and is carried to one corner of the anastomosis. A second suture is started in the middle posteriorly and carried in the opposite direction (Fig. 483 A). Both sutures are advanced along the anterior aspect of the anastomosis to meet anteriorly (Fig. 484 A) where they are tied together. The anterior layer is reinforced with a series of interrupted silk sutures placed 5 mm. apart through the serosa and the muscularis (Fig. 484 B). Some surgeons prefer the internal suture to be interrupted, but the continuous suture has the advantage of being hemostatic.

The defect in the mesentery is closed with interrupted silk sutures, being careful to avoid the vessels in the mesentery.

**Technic: Mikulicz Operation for Carcinoma of the Sigmoid.** Since in gynecology the sigmoidal mass is usually discovered through a mid-line incision, a second incision in the left rectus region is made at a point most suitable for delivering the mass. The mass is lifted out of the abdomen after the sigmoid has been mobilized sufficiently by cutting the lateral peritoneal reflexion to permit 1 or 2 inches of bowel on either side

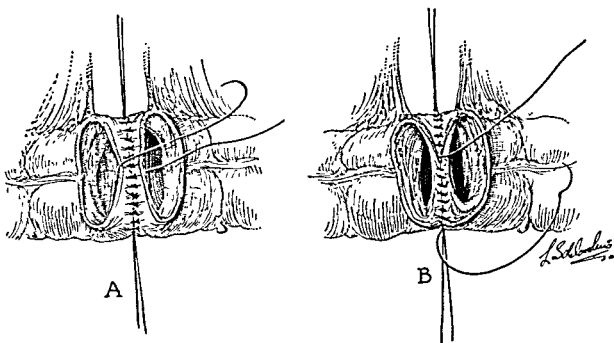


FIG. 482. (A) Interrupted seromuscular silk sutures have been placed. (B) The mucosa is approximated with a continuous "over and over" suture of No. 000 chromic catgut, beginning in the middle posteriorly.

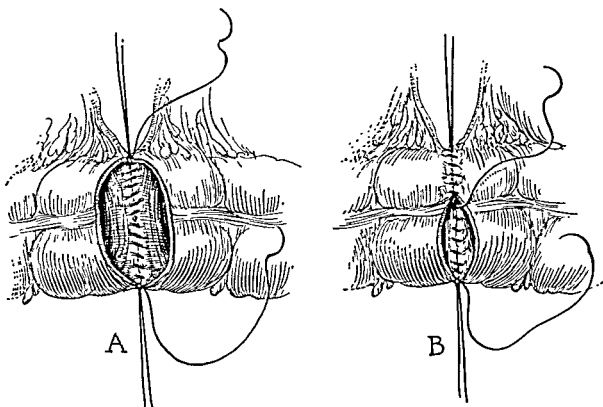


FIG. 483. (A) The posterior continuous mucosal suture has been completed. (B) The mucosal sutures are continued anteriorly from either side.

of the growth to be withdrawn from the abdomen. The mesosigmoid is cut, and vessels that supply the segment to be resected are ligated (Fig. 485 A and B). The anti-mesenteric sides of the two parallel loops of bowel are sewed together with interrupted stitches of fine silk laid in parallel lines that are united across the base (Fig. 485 C). The peritoneum is closed snugly about the bowel loops (Fig. 485 D), and the skin is sutured to the bowel wall with interrupted sutures of fine silk.

If obstructive symptoms are not present, the mass may not be removed until from 3 to 7 days afterward. If obstructive symptoms develop, the mass may be removed immediately. The mass is cut off with the actual cautery under a short Pentothal Sodium anesthesia. The cut is made a short distance from the skin, and the two ends of the gut protrude like a double-barreled gun.

After several days and when all obstructive symptoms have disappeared, the continuity of the bowel lumen is established by placing a long clamp on the septum and closing it gradually (Fig. 485 E). The exact positions of the proximal and the distal loops are ascertained by inserting the fingers into the bowel before applying the clamp on the

septum. The clamp is tightened a notch a day so that the bowel wall is cut through in about 5 or 6 days. The clamp is left on the septum until it drops off. The result of the crushing is determined by digital examination. If it is found that sufficient lumen has not been established, further crushing should be done.

At any time after establishment of the lumen the artificial anus may be closed by making an elliptical incision about it. The incision is carried down through the layers of the abdominal wall, and sufficient bowel is freed to permit the edges of the bowel to be brought together. Usually the bowel wall should be closed transversely. The bowel edges are inverted, usually with a double row of Lembert sutures. Generally, this closure can be done without opening into the peritoneal cavity. If the peritoneal cavity is opened accidentally, closure is then made. The abdominal wall is restored by closure in separate layers. If layer-for-layer closure is impossible without considerable tension, the wound may be closed with silver-wire sutures placed through and through. Administration of sulfasuxidine for several days before closure greatly increases the chances of primary healing.

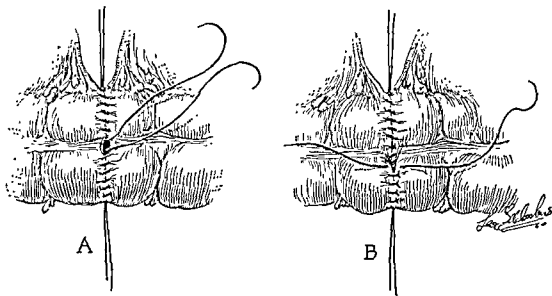


FIG. 484. (A) The mucosal sutures meet in the middle where they are tied. (B) The anterior layer is reinforced with a series of interrupted silk sutures through the serosa and the muscularis.

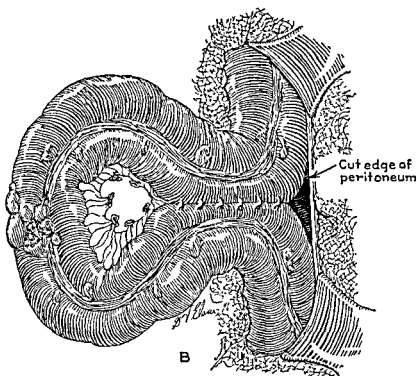
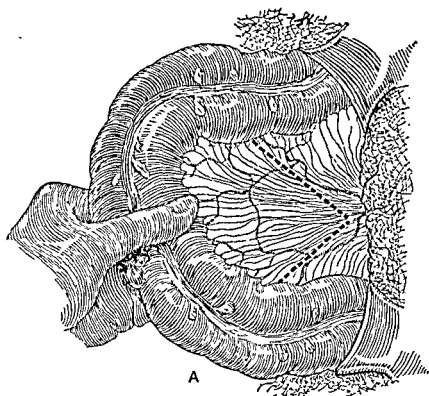


FIG. 485. Mikulicz operation for carcinoma of the sigmoid. (A) Indicating the line of ligating the mesenteric vessels. (B) The first line of interrupted silk sutures has been placed.



## REGIONAL ILEITIS

Regional ileitis is of importance to the gynecologist from the standpoint of differential diagnosis and also of treatment when the condition is encountered accidentally at laparotomy. Hence, a brief review of symptoms, differential diagnosis and treatment are in order in a work on operative gynecology.

Before the identification of this condition as a disease entity by Crohn and his co-workers in 1932, it was thought to be a form of intestinal tuberculosis. It may best be described as a granulomatous disease of the intestine affecting most often the terminal ileum of young adults. However, in some instances the rest of the small intestine may

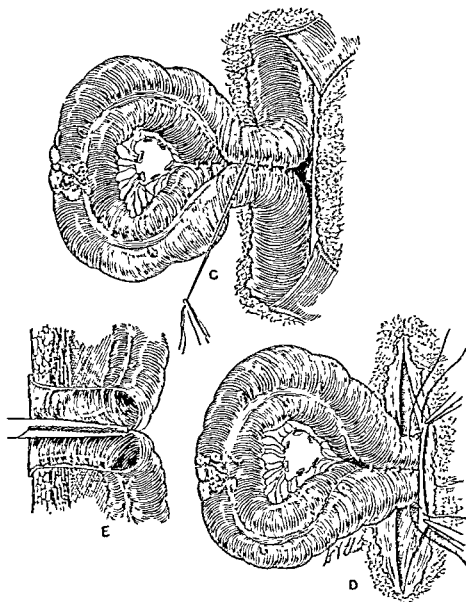


FIG. 485 (Continued). Mikulicz operation for carcinoma of the sigmoid. (C) The second line of interrupted silk sutures is being placed (D) The second suture line has been completed. The peritoneum is attached to bowel wall. (E) Ochsner clamp crushing the septum.

be involved, and the affected portions are not always in continuity. The colon, especially the cecum and the ascending colon, is not uncommonly diseased along with the terminal ileum. Studies attempting to pin its etiology to a specific bacterial infection, a virus, allergy or to a psychosomatic cause have all resulted in failure.

The symptoms of ileitis vary considerably, depending on the stage of the disease. In the acute stage there is pain in the right lower quadrant, nausea, vomiting and elevation of temperature and leukocytosis. Intermittent diarrhea and intestinal cramps accompany the above. At this early stage the mistaken diagnosis of appendicitis is common, and an operation is done. As the disease progresses, ulceration of the bowel wall is apt to occur, and diarrhea persists, often with blood and mucus in the stools. Malaise, loss of weight and anemia develop, and low-grade fever is common. As fibrosis of the bowel progresses, symptoms of partial obstruction develop with recurring abdominal cramps, borborygmus and visible bowel patterns. A mass is often palpable in the right lower quadrant. Such a mass is usually higher than an adnexal mass, but in some instances it is sufficiently close to the uterus to be mistaken on bimanual palpation for an adnexal enlargement.

The important thing for the gynecologist to bear in mind is the possibility of regional ileitis and to pause in his plan for surgery long enough to obtain gastrointestinal studies. Barium enema is usually normal unless there is rather extensive involvement of the colon. The barium meal in the typical case reveals dilated loops of small intestine accompanied by distal loops of small intestine narrowed and rigid. However, in many instances when the disease has not progressed to the advanced cicatrizing stage only stasis and dilatation are seen without any particularly characteristic features. In the advanced stage of the disease abscess and abdomino-intestinal fistulas are common. Injection of these fistulous tracts with opaque media may aid diagnosis.

**Treatment.** The early reports on the surgical treatment of regional ileitis were rather optimistic but, like so many medical conditions, the longer the period of follow-up, the

greater is the percentage of recurrence. Views on therapy differ widely. Some men of wide experience, such as Garlock and Crohn, believe that there is no satisfactory medical treatment, while others advocate medical treatment in the early stage of the disease. Most observers agree that cure without surgery may occur, either because of or in spite of medical treatment. Such treatment is aimed at maintaining the body nutrition, relieving pain and diarrhea and building up the blood. This consists chiefly of a high protein and carbohydrate diet, with low residue and the administration of vitamins, liver, iron and calcium. Because many of these patients have psychosomatic troubles, it is advisable to treat these when indicated.

The medical treatment of regional ileitis concerns the gynecologist less than what to do surgically when it is encountered accidentally. Incidentally, the gynecologist should encounter it only accidentally. When the diagnosis is made preoperatively, only the best of gastroenterologic surgeons should undertake the operation. Even if one is inclined to the medical treatment in the early stage of the disease, the need for surgery in a substantial proportion of the cases will be apparent. Abscesses, fistulas, obstruction or hemorrhage will compel surgery, as well as the other symptoms which may progress in spite of conservative treatment.

Surgical opinion is divided as to the best procedure. Garlock and Crohn believe that they have collected enough material to compare resection and short-circuiting procedures. They report 55 primary resections with 9 operative deaths and a recurrence rate of 19.5 per cent. In comparison, they present 65 cases in which short-circuiting procedures were carried out with no operative deaths and a recurrence rate of 13.8 per cent. Therefore, they are strongly in favor of the short-circuiting procedure. Some operators have performed a second-stage removal of the diseased ileum and lymph glands after a primary ileotransverse colostomy or ileosigmoidostomy with transection of the ileum. Garlock and Crohn have given this up because in most instances in which the bowel was removed it was shown to be healed and inactive in appearance. Also, they found that fistulas usually closed spontaneously with-

out resection. Furthermore, there appeared to be a higher percentage of recurrence after the second stage, and 3 of 25 of the patients died. Dixon of the Mayo Clinic has not had as good success in the closing of fistulas following ileocolostomy and advocates resection. Likewise, Marshall, in reviewing the experience at the Lahey Clinic, urges complete extirpation of all the affected bowel with wide resection of the affected lymph glands. Firor favors resection when the involved bowel is limited and easily resectable. If not, and especially in the presence of fistulas and abscesses, he favors ileocolostomy.

These, then, are the opinions of several experienced surgeons, and from them the gynecologist must make his decision when he encounters this condition in the abdomen.

### MECKEL'S DIVERTICULUM

Meckel's diverticulum is an anomaly which may be the seat of a variety of surgical diseases, some of which have a rather high mortality rate. The gynecologist is in a preferred position to prevent these diseases by removing the uncomplicated diverticulum when encountered in the course of pelvic laparotomy. Furthermore, the gynecologist may encounter the diseased diverticulum due to a mistaken diagnosis. Hence, this general surgical condition is given consideration in this volume. That the structure is often neglected is attested by the fact disclosed by Owen and Finney who showed that in a large percentage of the cases coming to operation because of disease of the organ, previous laparotomy had been done and the majority of the laparotomies were gynecologic.

In a recent survey of the condition in 3 Baltimore hospitals Owen and Finney found the diverticulum to be an average distance of 48.8 cm. above the ileocecal valve, the extremes being 6.5 and 91.5 cm. The diverticula may vary considerably in size and shape and have been described as conical, saccular, vermiform, filiform, hemispherical and sausage-shaped. The diameters of the bases vary from a few millimeters to the width of the small bowel, and the width of the base may determine the method of excision. The diverticulum may arise from the

mesenteric or antimesenteric border of the bowel but most often from the latter. When the diverticulum is long there is apt to be a distinct mesodiverticulum. In the majority of cases the mucosa lining the diverticulum is of the ileal type but, not uncommonly, heterotopic tissues, such as gastric mucosa, duodenal mucosa, pancreatic tissue or colonic mucosa are found. The presence of heterotopic tissue predisposes to the occurrence of complications. The most common complication in the younger group is hemorrhage, whereas in the older age group intestinal obstruction is more common.

The preoperative diagnosis of disease of Meckel's diverticulum is rarely made correctly. Most commonly the diagnosis of acute appendicitis is erroneously made, but the pain caused by the diverticulitis may simulate disease of the pelvic organs. The symptoms produced by the diverticulum are caused by the complications. The passage of fresh blood per rectum is the commonest symptom and indicates mucosal ulceration. As a rule, the blood is not mixed with mucus, which differentiates the condition from intussusception. Abdominal pain may vary in location but most often is in the preumbilical region, later migrating to the right lower quadrant. The pain has no relation to the ingestion of food. Nausea and vomiting commonly follow pain. If the disease proceeds to perforation, the signs of peritonitis ensue. If the complication is intestinal obstruction, the usual symptoms of that condition are manifest. A flat x-ray plate may show fluid waves, but otherwise x-ray studies are of no help in diagnosing the presence of a diverticulum.

**Treatment.** Gynecologists can make a real contribution to the treatment of the diseased Meckel's diverticulum by routinely searching for diverticula during pelvic laparotomy. It is an excellent rule to look for a diverticulum in all cases unless the patient's condition forbids the prolongation of the operation by a few minutes or unless handling of the intestines would disseminate infection. It is especially important to search for the anomaly during an operation for appendicitis, when the gross appearance of the appendix fails to explain adequately the patient's symptoms

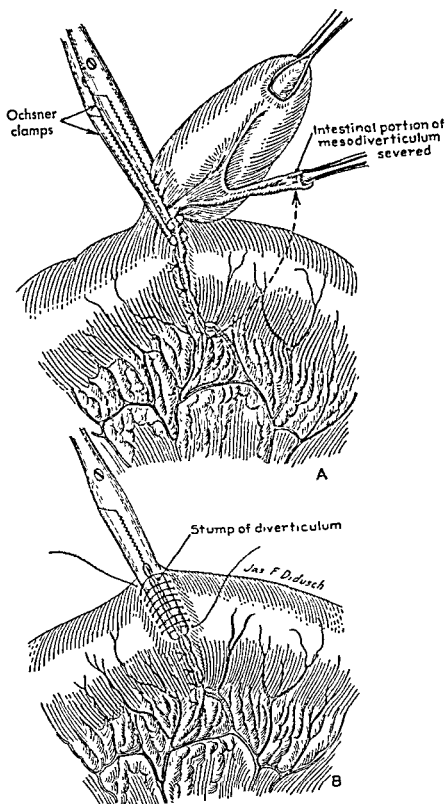


FIG. 486. (A) Meckel's diverticulectomy. The mesodiverticulum has been ligated, and the base of the diverticulum has been doubly clamped with Ochsner clamps. (B) The intestinal incision is being closed with continuous inverting suture.

and in those cases in which the pelvic lesion does not satisfactorily account for the abdominal pain.

In general, when an uncomplicated diverticulum is found it should be removed unless the condition of the patient contraindicates further surgery. Such cases are rare, but if the abdomen is closed without removal of the vestigial organ the patient should be told of its presence. Such knowledge may prove to be of great value to the patient or to the physician subsequently.

The method of removal of a Meckel's diverticulum, using the technic employed for appendectomy, is quite satisfactory in certain uncomplicated cases when the base is less than 1 cm. in diameter. Owen and Finney stress the inadequacy of this method when the base of the diverticulum is wide and particularly when there is evidence of complicating disease. They call attention to the fact that not uncommonly heterotopic gastric mucosa with ulceration and perforation is found in the neck of the diverticulum or on the ileal margin. It is obvious that simple crushing, ligating and amputation at the neck may leave an island of gastric mucosa which may later ulcerate and bleed.

A satisfactory method of removing a diverticulum with a wide base is shown in Figure 486. Figure 486 A demonstrates the diverticulum with its mesentery containing the vitelline vessels. In B these vessels have been ligated, and the base of the diverticulum has been doubly clamped. The distal end of the diverticulum is grasped with a Babcock clamp which is used for traction. The surrounding operative field is protected with moist gauze. Amputation is made between the 2 clamps with a carbolic knife or cautery. A Connell suture of No. 00 chromic catgut on a curved atraumatic needle is placed along the clamp, and the clamp is withdrawn as the ends of the suture are held under tension. The two peritoneal surfaces are thus brought into apposition. The transverse suture line is reinforced with interrupted Lembert sutures of fine silk.

When Meckel's diverticulum is complicated by a perforation at or near the base, there may be a wide zone of induration unsuitable for suturing. A wedge-shaped dissection of the indurated segment of the

bowel, as shown in Figure 487, may be necessary. The involved portion of the bowel is isolated from the rest of the peritoneal cavity by moist gauze. The distal end of the diverticulum is grasped with a Babcock clamp. The mesodiverticulum is clamped, cut and ligated. Four traction sutures of fine silk are placed with French needles in the wall of the small intestine just beyond the neck of the diverticulum, 2 being in the transverse and 2 in the longitudinal axis of the bowel. Clamps are placed on these traction sutures. With traction being made in the longitudinal axis, 2 small Kocher clamps are placed just within the traction sutures so that they meet at the mid-point of the base of the diverticulum adjacent to the traction sutures in the transverse axis. These clamps are placed at about 90° to each other, as shown in Figure 487. Two other Kocher clamps are placed distal and parallel with these, and the diverticulum is excised between them. The traction sutures in the longitudinal axis of the bowel are then withdrawn. The Kocher clamps are removed, and individual bleeders in the intestinal wall are clamped with mosquito clamps and ligated with very fine catgut. The adjacent lumen of the small intestine is aspirated to prevent seepage during the suturing of the wound. The 2 traction sutures or mucosa clips in the transverse axis are put under gentle tension, and a Connell suture of No. 00 chromic catgut on a curved atraumatic needle is used to close the wound transversely to the axis of the bowel. The suture line is reinforced with a single layer of Lembert sutures of fine silk. The 2 remaining traction sutures are withdrawn.

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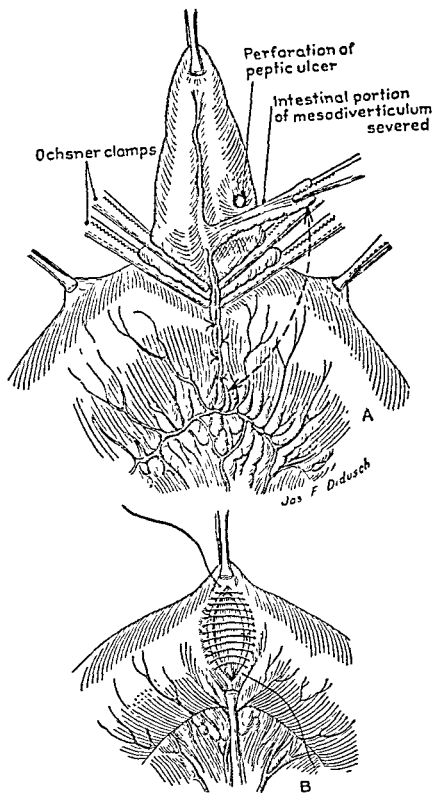


FIG. 487. (A) Diverticulectomy, open technic. The large base has been doubly clamped. (B) The longitudinal incision is being closed transversely in order not to narrow the intestinal lumen.

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# Estrogen Therapy of the Menopause

## GENERAL CONSIDERATIONS

The menopause may or may not be symptomatic. Many women simply cease menstruation without any disagreeable symptoms. This statement is true whether the menopause be natural or brought on prematurely by surgery or irradiation. Women who are inclined to be emotionally unstable are more apt to have a stormy time during their climacteric than those of more stolid temperament. On the other hand, some women who have lived their premenopausal lives in relative tranquillity may become greatly disturbed when ovarian function fails. Hot flushes or flashes, often accompanied by drenching sweats, are the most constant of the symptoms, and headaches are the second most frequent. Palpitation, emotional instability, mental depression, indefinite paresthesias and pains may all be a part of the picture. One of the major factors in the menopausal syndrome is the building up of fear of the menopause as a result of tales handed down to women by their mothers or older friends who have passed their climacteric and have known others who have done so with many disagreeable symptoms. It is depressing to many vain women to know that they have turned the corner and that physical changes indicative of advanced years are imminent. A common fear that often aggravates the situation is the mistaken belief that after the menopause sexual activities are at an end. Women are often more concerned about the effect of this upon their husbands than about their own loss of sexual pleasure.

Before considering replacement therapy, the treatment of the menopause psychologically should be considered. A simple explanation to the woman that the menopause does not represent the termination of sexual

pleasure may be very heartening to her. Further assurance to her that the menopause does not in itself usher in ugly obesity and pronounced change in body form may relieve her unwarranted anxiety. She may be told honestly that if she curbs her appetite and does not neglect regular exercise she may retain her "youthful" figure for many years. She may be given assurance that the menopause is not responsible for major psychoses, and that women are subject to psychopathic upheavals at all times of life, as are men. A few moments spent in such explanation may be worth much more than medication to many women. Sedatives, such as phenobarbital given in doses of  $\frac{1}{2}$  grain not oftener than 3 times a day, may be all that is necessary to quiet the patient in some of the less symptomatic cases. The newer tranquilizers are used advantageously by some women but by no means all. Equanil in dosage of 400 mg. taken as necessary for nervousness, but not over 3 times a day, is very helpful to some but is quite disagreeable to other women who may do very well on small doses of phenobarbital. Loss of sleep may be the greatest factor of distress in some menopausal woman. Sedatives such as Seconal in  $1\frac{1}{2}$  gr. dosage at bedtime may not only help their insomnia but also improve their sense of well-being the next day.

Before considering estrogenic therapy a few words should be said about its abuse. One of the greatest quackeries practiced by the rank and file of the medical profession today is the indiscriminate use of estrogens for vague symptoms in women of 40 or beyond. More objectionable and even dangerous is the use of estrogens for irregular bleeding without proper pelvic examinations to investigate the cause of the bleeding. Upon



investigating the causes for delay in proper treatment of uterine cancer one is immediately struck by the great number of instances of this improper use of hormonal therapy.

Within the past few years considerable literature has appeared supporting a view which in the opinion of this author is extreme and not based on good clinical experience. We refer to the suggestion that all women without vaginal smear evidence of adequate estrogen function should receive estrogen therapy for life, whether this is after artificial or natural menopause. This is based on the belief that estrogen therapy prevents osteoporosis, premature arteriosclerosis and senile mental aberrations. In the opinion of the author there is no conclusive evidence that the above diseases of old age can be prevented by estrogen administration, and we still believe that estrogen therapy should be regarded as temporary support for the woman who has sufficiently severe menopausal symptoms to cause her to request relief.

In spite of the abuses of estrogen therapy there is a proper place for it in the treatment of definite menopausal symptoms. In fact, we believe that occasionally it may be used in doubtful cases as a therapeutic test for a short period of time. It is our belief that replacement estrogen therapy simply serves as a support for the woman during the months or years while she is becoming adjusted to estrogen withdrawal. We have not been convinced that the period of adjustment is either shortened or prolonged by the administration of the hormone. On the other hand, if the symptoms are mild, we do not urge the use of estrogens. Not infrequently after explaining to the patient the probable course of her symptoms she will choose to weather the storm without estrogen therapy. On the other hand, if the symptoms are severe, and if the patient has been relieved for a period by estrogens, she may request further relief.

#### METHODS OF ADMINISTRATION OF ESTROGENS

The procedure of administering estrogens parenterally at frequent intervals in order to maintain a sufficient level in the tissues has decided disadvantages. It is time-consuming to both the patient and the physician, and

the frequent hypodermic injections are disagreeable. It is also excessively expensive for people in moderate circumstances. In order to circumvent the inconvenience and the unpleasantness of parenteral administration the use of orally active estrogens has become widespread. Because of its cheapness and effectiveness stilbestrol has been used widely and on the whole effectively. We have found 0.5 mg. to be effective in controlling symptoms, and with this dosage nausea, vomiting and uterine bleeding are not common. With larger dosage nausea and vomiting often necessitate discontinuance of therapy. In a series of women treated in our dispensary, uterine bleeding occurred in 8.8 per cent if the dosage was 0.5 mg. or less, but if the dosage was 1 mg. or more, bleeding occurred in 36.3 per cent. The bleeding is usually not profuse, but occurring, as it does, during years when malignancy must always be seriously considered, a curettage is necessary to rule out cancer. The disadvantage of bleeding, of course, does not apply to those cases of the surgical menopause in which there is no uterus; it is in this group that we believe stilbestrol to be most useful.

Because we have not been entirely satisfied with either the parenteral use of the natural estrogens or with the oral use of stilbestrol, we have sought another method of administering the hormone. In 1937 Deanesly and Parkes announced a new technic in hormone administration in animals whereby solid pellets of crystalline hormone were implanted subcutaneously, to be absorbed slowly and continuously over a long period of time. Such pellets were found to be effective in producing prolonged hormonal stimulation in laboratory animals. In 1938 Bishop implanted a pellet of estrone subcutaneously in a young castrated woman who reported partial relief of menopausal symptoms; this relief lasted for 5 weeks. In 1940 Bennett, Biskind and Mark reported their results on 21 menopausal women treated with subcutaneous pellets of Theelin (estrone). They found that relief of subjective symptoms began on an average of 2 weeks after the implantation and persisted for as long as 14.5 weeks. They also discovered (1) that the urinary estrogen level rose and remained elevated for correspondingly long periods; (2) that the uri-

nary level of gonadotropic hormone was depressed in from 60 to 70 per cent of the cases; and (3) that prolonged stimulation of the vaginal mucosa occurred as observed in biopsy specimens. These objective findings were interpreted as showing, beyond doubt, that the Theelin was absorbed continuously from the pellets over long periods, and that

the estrogenic action of the absorbed Theelin was not impaired by the pellet method of administration.

MacBryde, Freedman, Leoffel and Allen implanted pellets of stilbestrol through small incisions, whereas Twombly and Millen implanted 20 mg. pellets of estradiol through 10 gauge needles. Mishell implanted large pel-

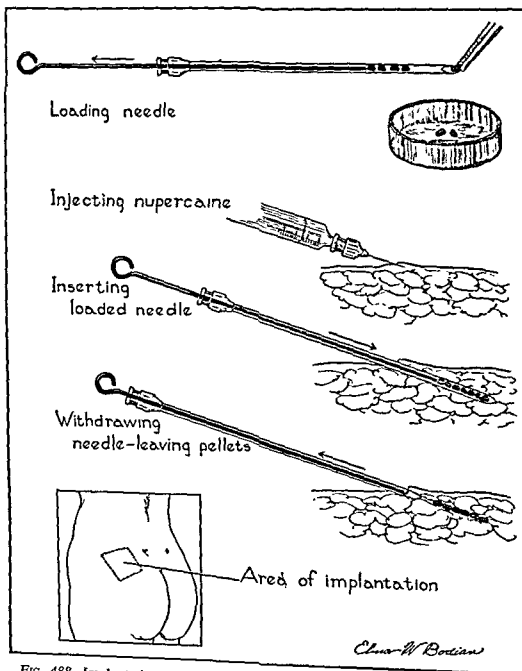


FIG. 488. Implantation of estrone pellets. The pellets are loaded into the needle after partial withdrawal of the stylet. The skin is infiltrated with nupercaine. The needle is injected into subcuticular fat. The needle is withdrawn after the stylet has been pushed in. Inset shows area of implantation which is sterilized with iodine and alcohol.

lets of crystalline estrogens, obtained by extracting pregnant mare's urine, through a small incision just above Poupart's ligament. Eighteen of 19 women so treated were relieved of their menopausal symptoms. In 1941 Bennett and Te Linde reported their results in 45 women treated by implanting multiple small pellets of Theelin (estrone) and described the technic which they employed. Since then we have had a much larger experience in our clinic based on a total of approximately 1,000 implantations in 500 patients. Because the technic is not yet generally known, we shall describe it here.

#### TECHNIC OF ESTROGEN PELLET IMPLANTATION

At the time of publication of the first edition of this book, estrogen pellets were not made commercially. During the several years since then, we have used many pellets of pure crystalline estrone, which we have made with a small pellet-compressing machine. The pellets are 1.83 mm. in diameter and are of such length that 3 of them weigh 50 mg. By trial and error we have arrived at the dosage of 50 mg. per implantation. The pellets are sterilized in a dry steam autoclave at 250° F. under 15 pounds of pressure for 30 minutes. The implantations are made through a 12-gauge hollow needle fitted with a stylet (Fig 488). The pellets are loaded with sterile forceps into the pointed end of the needle after the stylet has been partially withdrawn.

The skin over the gluteal region is prepared by painting with full strength tincture of iodine which is allowed to dry; then it is washed off with alcohol. A spot is infiltrated with 1:500 Nupercaine solution, and the loaded needle is inserted obliquely beneath the skin. As the needle is withdrawn, the stylet is pressed in and the pellets are implanted subcutaneously (Fig. 488). A small dry gauze dressing is placed over the injection site and left there for a week. The implantation is quite painless and can be done easily as an office procedure.

Because a foreign object is being introduced into the tissues, the most rigid sterile technic must be observed. We have noted a few infections which were not severe. These occurred in the earlier days of our experi-

menting when the skin was prepared with alcohol alone. In none of these cases of infection did the implanted pellets slough out, but there was an indurated, reddened area at the site of implantation. This necessitated the use of a protective dressing for a few weeks.

It is interesting to note that these cases complicated by local infection showed little or no relief of symptoms. This indicates, we believe, poor absorption due to fibrosis and to diminished blood supply about the infected foreign material. Because, then, of this danger of infection, the gluteal region is prepared for implantation by painting with full strength tincture of iodine and washing it off with alcohol. Since we have used this method of antisepsis, we have had no infections and conclude that the danger of infection is negligible when proper technic is followed.

There have appeared on the market pellets similar to those that we have used during the past several years. They are put out in small, sterile glass tubes. Each tube contains 4 sterile pellets of 12.5 mg. each, making a dosage of 50 mg. The tube is broken in a sterile sponge after the outside has been thoroughly swabbed with alcohol. In order to load them into the 12-gauge needle they must be emptied into a small sterile dish so that they can be loaded with a pair of sterile tweezers into the needle. The great advantage of the small pellets is that they can be implanted by a needle rather than by a trocar.

Estradiol is available which is compressed into a 25 mg. tablet. This small white sterile tablet is placed under the skin in the subcutaneous tissues, using the Kearn's injector needle. After making an intradermal wheel with procaine, a short incision is made in the skin to admit the large needle. The skin incision is closed with a band-aid, reinforced with adhesive. Gray has had considerable experience with these 25 mg. pellets of estradiol, and his results are discussed later in this chapter.

#### CLINICAL RESULTS

In evaluating the results of pellet implantation we, as well as most other investigators,

have considered the relief of hot flashes to be the most definite criterion of success. In the first publication of Bennett and Te Linde they reported satisfactory results in 93.4 per cent of the treated cases. In a larger series of 300 patients in whom 500 implantations were made in our clinic the results have continued to be equally good. Approximately 2 weeks usually pass before sufficient estrone is absorbed to become effective. There are exceptions to this rule, however, for we have observed a complete cessation of menopausal symptoms within a week after the implantation. On the other hand, in a few individuals, a month has elapsed before the flashes have subsided. If no benefit is observed within a month, usually no subsequent benefit can be expected. As a rule, the flashes disappear gradually, there being a progressive diminution in intensity and frequency. With the subsidence of the flashes, the feeling of nervous tension likewise disappears, and a feeling of well-being is established.

The relief of symptoms lasts, on an average, 4 months, but occasionally the flashes return after a shorter lapse of time; relief for 7 to 8 months is not uncommon. In a few instances, there has been no return of menopausal symptoms for an observed period of 2 years. We are inclined to regard these permanent "cures" as cases in which the menopausal symptoms would have been of relatively short duration even without the implantation. We have seen no evidence that the normal period of adjustment of menopause is shortened by this substitutional therapy, nor have we been able to observe that it is lengthened. When the flashes do recur after a period of freedom, following an implantation, they usually recur in a milder form and are easily controlled by another implantation.

It has become apparent to us that the best results are seen in women who are treated relatively early after the onset of symptoms. The results are not as striking in those cases in which menopausal symptoms have been present for 3 or 4 years, and the patient has become entrenched in her symptomatology. Also, one cannot be certain of the success of implantation treatment in obviously neu-

rotic women. However, we have used it, at times, as a therapeutic test in such individuals, and have frequently been surprised at the marked improvement in some of the patients whose symptoms we were inclined at first to regard as neurotic rather than menopausal.

With the exception of a few cases of infection at the site of implantation, which we have noted above, we have observed no unfavorable effects. Abnormal bleeding occurred only once in the first 28 cases reported by Bennett and Te Linde. We have seen it only a few times in our much larger series of cases. Since abnormal bleeding is common during the menopausal years, one might expect coincidental bleeding occasionally. In fact, in a series of control patients treated with phenobarbital, there was abnormal bleeding in 6.3 per cent, a greater incidence than occurred in our patients treated with estrone implantations.

Gray, who has had considerable success with the estradiol pellets, considers that that form of therapy is particularly suited to women who have had a hysterectomy and double salpingo-oophorectomy. In most of Gray's patients the hormonal effect could be observed for more than 6 months. He considers the presence of an intact uterus, which might bleed, as a contraindication to estradiol implantation and prefers oral medication for these patients.

Recently, Soule and Burstein reported their results in a series of 150 patients in whom a hysterectomy and a double salpingo-oophorectomy had been done who were treated with compressed pellets of 50 mg. of estradiol implanted in the subcuticular fat. Ninety-eight per cent of the patients so treated were subjectively free of acute post-surgical menopausal symptoms during the first 6 months. They, like Gray, consider the presence of an intact uterus a contraindication to the use of estradiol pellets because of the likelihood of bleeding. This tendency of estradiol implantations to cause bleeding is well recognized; therefore, if one is to implant pellets for symptoms of the menopause in women with intact uteri, estrone appears to be the hormone of choice.

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